# TREES & TREE PLANTING

Parker O. Anderson

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# TREES
# & TREE PLANTING

Together with a Descriptive Catalog of

## Common Forest Trees of Minnesota and the Lake States

by

PARKER O. ANDERSON
*EXTENSION FORESTER*, UNIVERSITY OF MINNESOTA

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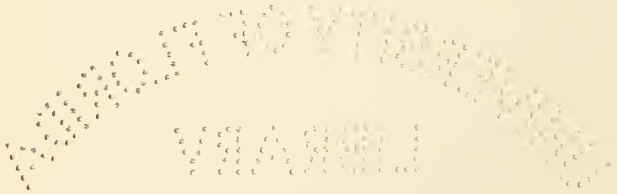

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## ACKNOWLEDGMENT

The author and publishers make grateful acknowledgment to the Division of Extension, College of Agriculture, University of Minnesota, for the use of illustrations showing the various trees described in this book. The helpful encouragement extended and the belief in the useful purpose that such a tree guide will serve for rural youth, adults, schools, and outdoor organizations, has aided greatly in its preparation.

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# PREFACE

SINCE the beginning of the world trees have been man's best friend, and they have played a definite and important part in his development and advancement through the ages. Trees are an investment assuring economic security. They clothe the world with beauty, give unhesitatingly of their protective shelter, and provide the needed material for homes, commerce, and trade. They safeguard and are the mothers of our streams, provide recreational opportunities for the future, serve as homes for our wild game and song-birds, and contribute to conditions of fish life. The history of America was begun with a forest background which contributed the homes, the food, clothing—the trade and commerce of early American beginnings. They still form one of the most important economic resources of this land of ours.

Too many people go through life, coming often or constantly in contact with trees and forests, without knowing the names of a dozen species of trees common in their own regions, and unable to identify half that number when they find them in their native surroundings. Yet every individual who acquaints himself with these friendly, important servants of man's economic welfare opens a door offering better and more abundant living.

In recent years there has been a constantly increasing interest in matters relating to the use of trees in both city and open country, an interest manifested in the encouraging and rapid development of youth and adult organizations interested in outdoor programs and problems. This little booklet has been prepared with the hope that it will be of material assistance in bringing to more of our people a fuller understanding and appreciation of our most useful citizens—the trees.

—PARKER O. ANDERSON

Saint Paul, Minnesota.

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# PART I

# TREES & TREE PLANTING

## GOOD TIMBER

*The tree that never had to fight*
*For sun and sky and air and light,*
*That stood out in the open plain,*
*And always got its share of rain,*
*Never became a forest king,*
*But lived and died a scrubby thing.*

*The man who never had to toil,*
*Who never had to win his share*
*Of sun and sky and light and air,*
*Never became a manly man,*
*But lived and died as he began.*

*Good timber does not grow in ease;*
*The stronger wind, the tougher trees;*
*The farther sky, the greater length;*
*The more the storm, the more the strength;*
*By sun and cold, by rain and snows,*
*In tree or man, good timber grows.*

*In thickest stands of forest growth*
*We find the patriarchs of both;*
*And they hold converse with the stars,*
*Whose broken branches show the scars*
*Of many winds and much of strife.*
*This is the common law of life.*

DOUGLAS MALLOCH.

# I

# THE TREE

EVERY tree has something definitely characteristic about it that should register with appreciative and careful observers as they become better acquainted with various tree individuals and tree families. The tree is a living, definite organism; its cell structure, its manner of growth, its method of reproduction and life work are comparable in many ways to similar structures and functions of the animal world, with the exception of its inability to move about from place to place. Comparable to animal organisms, it consumes food, breathes, transpires, reproduces its kind, utilizes energy, gives off waste, and prefers to associate with others of its kind and even to form and live in communities.

A tree is first of all a woody plant, its main stem containing a large number of cells and tissues which we know as *wood.* If and when the stem of this plant reaches a height of eighteen to twenty feet without support it is referred to as a *tree.* A woody plant below this size is usually referred to as a *shrub,* and should the stem of such a woody plant need support, it is called or referred to as a *vine.*

Trees which drop their leaves prior to or during the winter, so that limbs are naked are termed *deciduous,* while those that apparently retain their leaves all year 'round are termed evergreens or *conifers* (cone-bearing as the last name indicates). Although evergreens seem to retain their leaves all year 'round, they do shed their leaves, but not all at the same time. New leaves are formed each year on the new twigs and some even on the older twigs. The shedding is so gradual, however, that it is not noticed, hence the belief that evergreen leaves remain constant.

The tree proper is broadly divided into three definite parts: (1)the roots; (2) stem or trunk, and (3) crown (leaf area). All these parts work in particular and def-

inite cooperative relationship to each other and depend upon each other for successful functioning and continuation of the tree specie.

## ROOTS

The roots growing below ground, are seldom seen (unless a tree is dug out or the soil is washed away, exposing the root systems), so their great importance and important functions are lightly passed over by the average individual. The roots have various important duties: first, that of anchoring the tree to the ground, thus enabling it to stand in an upright position; second, its most important function, that of absorbing raw food material, particularly needed mineral salts and water, from the soil in which it is growing. The larger main roots, so easily noted, serve chiefly as anchor roots, but they also act as a main transport channel for mineral salts and water supplied by the smaller roots and rootlets, the important job of which is to search out and gather in these necessary food and moisture particles.

One important fact often not appreciated by people transplanting trees is that the root system is just as extensive below the ground as are the branches and foliage above the ground. If this were not so, the demand for food material by the crown could not be supplied by the roots and the tree would starve, cease to grow, wither, and eventually die. This is an important fact to remember in transplanting or purchasing a tree. Do not confine your entire attention to the top; look also at the root systems. If a tree has lost much of its root system prior to transplanting, the crown should be reduced to compensate for and balance this loss.

Two main classes of root systems are easily recognized—the shallow or spreading type and the deeply penetrating or taproot type. Trees found growing on thin fertile soil, or where moisture is close to the surface, have the shallow type. Trees with deeply penetrating or taproot systems are most commonly found growing in drier locations but where soil is deep. The depth of penetration, however, will depend upon soil type and distance to moisture.

When we speak of trees being wind firm, we usually have in mind taprooted trees, species which are usually less influenced by surface conditions caused by wind, reasonable drought, freezing, etc. The character of the

soil also plays a definite part in wind firmness. If the soil is loose and very porous or fully saturated with water it naturally offers less anchorage. Examples of trees with representative taproot systems are white pine, white oak,

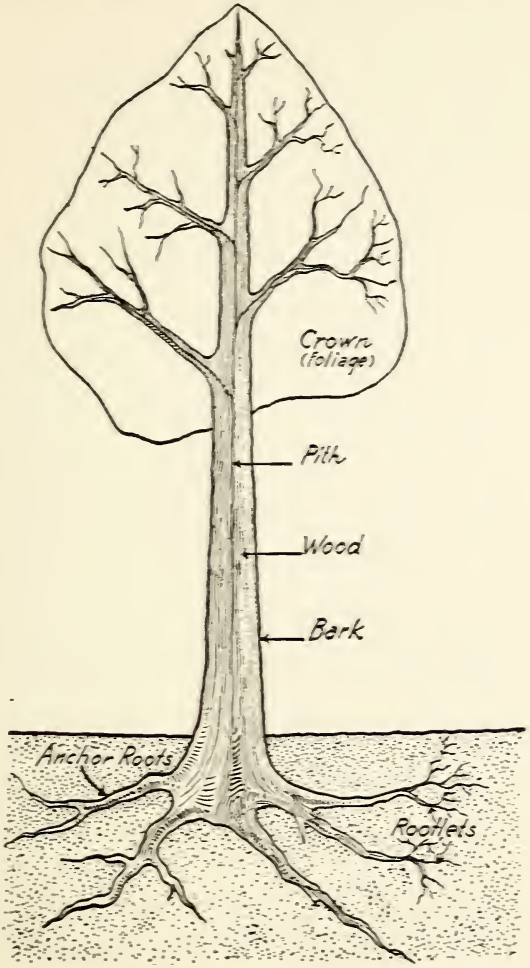



FIG. 1. THE TREE, SHOWING VARIOUS PARTS

walnut, etc.; those with spreading or shallow root systems are soft maple, willow, aspen, etc.

## STEM OR TRUNK

The stem is that portion of the tree above ground which supports the foliage or crown, holding it up to the sunlight. The other main function of the stem is to provide a transporting system for the water and minerals gathered by the root systems which is needed by the food manufacturing plant which is located in the crown. The trunk or stem is of the greatest economic importance from the standpoint of timber and other forest commodities required by industrial or human needs.

From a commercial standpoint and for forest considerations, a long, clear stem with minimum of taper is desired. Such a stem permits the utilization of the greatest number of logs and supplies more marketable board feet.

For shade or ornamental purposes, a long, clear stem is usually not desired, but rather a trunk having more limbs to furnish shade or greater beauty.

A cross section of a cut tree (stump) will show several distinguishing regions. (See Figure 2.) The center region is called the *pith;* this part was the main portion of the tree in its early beginning or when it was one year old. During this early period the pith functioned as a food storage area. Since that time, as new layers of wood have grown around the outside each year, it has served little or no purpose.

Between the pith and bark is the *wood;* the portion which gives strength and support to the tree trunk.

The center, heavier portion is composed of dead wood cells which have ceased to function. These cells being thicker-walled and more definitely colored are known as *heartwood.* Heartwood is stronger, more durable, and does not undergo as many physical changes, such as shrinkage and drying, as the outer or younger cell growth. Heartwood, therefore, usually has a higher commercial value.

The outer or young layers of wood are lighter colored, thinner-walled cells; this younger wood region is known as *sapwood.* It is in this outer or sapwood area that the upward movement of moisture and food occurs.

The *bark* (like the human skin) is the outside protective covering of the tree and as such protects the tree from outside injury and also seeks to prevent undue evaporation from the inner, active cells. Plants know what

losses of water mean and go to some extremes to protect against any such losses. At the extreme outside the bark cell structure is heavy and corky; while the inner, thinner cells conduct the food which has been manufactured by the leaves down through the trunk, where it is distributed to various portions of the tree for its necessary life functions.

Directly between the bark and the wood is found a thin film of active live cells. This is the *cambium layer.* These cells are the only active growing cells. In favorable growing seasons these cells divide, multiply, and enlarge, forming a layer of new wood cells completely around the entire tree trunk, branches, and twigs. This is the manner in which trees grow, and explains why we see the annual rings noted in the cross section. In addition, however, to forming new wood growth on the inside, the cambium cells also form bark cells toward their outer region.

Fig. 2. Cross Section of Tree

1. Pith. 2. Heartwood. 3. Springwood. 4. Summerwood. 5. Sapwood. 6. Bark. 7. Cambium layer.

The outer growth of wood cells and the inner bark cells are therefore the youngest part of the entire tree plant. As the new wood cells are formed around the outside (throughout the entire length of the tree to the very uppermost branches and twigs), the tree under normal conditions, grows in diameter, height and width each year.

In the process of growth the bark stretches and splits, thus making the corrugations, flakes, or ridges of bark so typical to various tree species and tree families.

In the early part of the summer when growth is very active the new cells are larger, but toward late summer growth slows up. Closer and further examinations will indicate quite readily the spring and summer wood formed, as well as the final rest period, during unfavorable periods, such as winter. In a cross section these records are noted as concentric rings and indicate annual seasons of growth at the particular point examined. Because one new layer of wood is usually formed during each growing season, these rings are known as annual rings. The de-

markations are quite apparent, because cells formed in late summer are smaller, thicker walled and have denser wood. This late growth is called summer wood, while those formed in the early part of the growing season, being thinner walled, less dense, have larger wood cells and are lighter in color, are referred to as spring wood.

The annual rings, therefore, preserve very graphically the historic record as to growth, moisture and other growing conditions to which the tree has been subjected.

As in diameter growth, the height growth is carried forward by the same group of cambium cells, but at the tips or ends of branches. The new cells push the growth further upward and outward.

In early growth of young trees, height growth is quite rapid, slowing down in later years until the tree has reached its normal height (just as growth does in the human family). Activities of height growth, when slowed down on reaching normal height, are transferred to diameter growth and to other activities tending toward reproduction and the mature development of the species.

## THE CROWN

The crown is composed of branches, twigs, and leaf area. In the crown we find located the food manufacturing plant. The leaves manufacture the food while the twigs and branches act merely as a support for the leaves, to display them to best advantage in the sun which helps in the process of food manufacture.

In the leaves, those elements which have been extracted from the soil by the roots and are later transported up through the woody stem, are combined with the necessary gases of the air, and through the action of the sun produce sugar and starches needed by the tree for growth and life functions.

The leaf area reflects the health, extent and vigor of growth. A reduction in normal leaf area will be evident by a slowing up or decreased growth, which, if too severe, results in death.

Leaf-eating insects, tree and leaf diseases have a definite influence on tree growth and health. Crown development and vigor are therefore good indicators of growth and health.

# II

# FACTORS INFLUENCING GROWTH

THERE are three major factors that control the growth and health of trees: type of soil, availability of moisture, and degree of light.

## SOIL

The character and chemical properties of soil exert a tremendous influence on tree growth although trees exact less fertility during their stages of growth than do regular annual farm crops.

The annual deposit of leaves and tree litter furnishes fertilizer and humus cover that tends to improve soil on which a tree is growing. Leaves especially contain a concentration of inorganic salts which, when dropped and rotted down, add to soil richness. In European countries the fertilizer value of deciduous leaves is recognized and made use of. Leaves also increase the moisture-holding properties of soil, a fact readily observable in areas where ground humus has been burned off or where leaf mold has been washed away. Studies have been made which have determined the decreased forest or tree growth resulting from the removal or loss of annual leaf and tree litter.

Trees are affected more by soil texture than they apparently are by chemical composition, except where there is rather high concentration of certain salts. The soil must be open or porous enough to allow air penetration through the soil surrounding the roots.

## MOISTURE

The distribution and extent of tree and forest growth are controlled specifically by moisture. Without moisture there can be no growth or development. Moisture in the soil is necessary both as a medium to carry food and as an important and essential part of plant tissue. The growing parts consist of from 70 to 90 per cent water. The need and use of water can be definitely noted in

summer by studying trees growing in the open or in a forest. The air in a forest (or tree group) is more humid and cooler. Gallons of water are evaporated through the leaves every day by each tree growing in the open.

Tree roots, however, penetrate more deeply into the soil than those of annual farm crops. The root system searches for moisture not only in the surface soil, but penetrates deeply into the subsoil. A tree is more of a subsoil feeder than other plants, hence the distance to the water table is an important consideration in selecting trees for planting as well as an important factor in the distribution and character of tree species found growing in any particular spot or region.

## LIGHT

To carry on functions of growth and food manufacture, trees must have light. The amount of light required by different trees varies. Some species need fairly direct or much light while others can grow best in diffused light or in rather shady places.

Species that require a larger amount of sunlight are spoken of as *intolerant;* in other words they will not tolerate shade. Trees that can grow well without full sunlight are termed *tolerant,* because they will tolerate shade. Some species, however, may be found that would choose a position between these two conditions and they would be called partially tolerant or intermediate.

Under forest conditions it is often noted that small trees will be tolerant at an early age, but will demand more sun later in life. Where you find open stands naturally, the trees usually are of the intolerant species. Crowns of such trees are more open, the lower branches being reduced or absent, due to self pruning, leaving the trunk or stem fairly clear.

Trees, therefore, respond definitely to light influences, and will tend to grow toward light directions. You will often note the larger and heavier branches growing toward such light openings.

## III

# SELECTING TREES TO PLANT

IN SELECTING trees for planting, bear in mind climatic factors. Trees which grow in sheltered areas will not thrive in exposed places. Trees adapted to the milder sections of the South will usually not thrive in the colder sections of the North.

The first step should be to find out what trees are growing naturally in your region. Note the soil in which they grow; study everything about them. Then see if your proposed planting site fulfills the particular tree requirements. Choose that specie which is best suited to your purpose. It is better to have foresight and forethought than hindsight and disappointment. Some trees are adapted to a wide range of soil and climate, and, even though they do not happen to be found locally, may often be used with success. Others, however, require certain soils and other specific factors and so will be very limited as to use and range.

The purpose for which a tree is to be used should also be a definite deciding factor; another factor is the tree's length of life. A quick growing, short-lived tree should not be used, for example, on a permanent highway or in a city or park planting.

In case of doubt or lack of sufficient information, and before deciding on definite action, consult your state university, or the forestry departments of the university or state, which can and will be glad to help you with factual and practical information.

There is no particular economy in selecting large trees. The main advantage they possess is that large trees "show up" sooner. On the other hand, very small trees are handicapped by weeds and grass until they are able to grow above surrounding competition. A safe rule to follow for general forest or woodlot planting is to plant evergreens not over twelve to fourteen inches high; deciduous trees should be sixteen to twenty-four inches

high. In these sizes the trees are less expensive, easier to handle, and more may be planted per day with less subsequent loss. In transplanting trees in the above sizes, it is possible to get more of the entire root system, requiring less pruning-back of the top. The important consideration is a well-developed root system, rather than a large crown.

If trees are to be purchased, deal only with known, reliable nurseries, specializing in the varieties you desire to plant. The kind of trees to plant will be largely decided by the purpose the trees are to serve and the conditions under which they must grow.

### FOR ORNAMENTAL PLANTING

In selecting a shade tree, the following considerations should be kept in mind: (a) shade value of the tree considered; (b) ornamental value; (c) soil, moisture, and light requirements; (d) rate of growth and length of life; (e) height and spread; (f) habit (clean, etc.); (g) ability to withstand wind, sleet, insects and disease.

Because deciduous trees come closer to filling these requirements they are extensively used. Trees required for ornament must be straight, vigorous and of good form. A few of the trees which are recognized as fulfilling the above requirements are: American elm, green ash, white ash, white oak, red oak, hackberry, walnut, black cherry, hard maple, birch, certain willows, basswood, wild plum, mountain ash, evergreens, etc. Selection of the kind and type of tree will depend upon taste, planting plan, and location. Special features to consider oftentimes are the kind, color and character of flower, fruit or bark.

Least desirable trees are box elder, cottonwood, aspen and willow families, ironwood, etc.

### FOR FARM AND FOREST PLANTING

For farm and forest planting, small trees which are hardy and well suited to timber crop or protection features are chosen. For this reason, evergreens about four years of age, usually not over ten to fourteen inches high, with well-developed, compact root systems as a result of having been at least once transplanted, are highly desirable.

Deciduous trees two years old are large enough to assure satisfactory results. For the planting of some

species, rooted cuttings are desirable and more practical.

Every farm should have a good, practical windbreak located at right angles to prevailing winds, which usually means on north and west sides. The windbreak should be of sufficient length and depth to prevent storm winds from blowing through. The planting should therefore consist of several varieties to give support to other species and provide stimulation of growth; the combination should include fast growers, used as temporary trees, and the better, longer-lived trees, to provide permanent results. The windbreak should be planted at least one hundred feet from the main buildings.

For quick results, species of the willow and aspen families are generally used in windbreak planting. These include cottonwood, Canadian poplar, Northwest poplar, Norway poplar, Carolina poplar, diamond willow, golden willow, white willow, laurel leaf willow, as well as Chinese elm, caragana, Russian olive, common lilac, wild plum, chokecherry, box elder, soft maple, etc.

Longer-lived, desirable hardwoods used are American elm, hackberry, green and white ash. Black walnut, butternut and black cherry can often be used within their limits, depending upon soil and exposure.

The conifers should and do play an important part in a one hundred per cent windbreak. The following varieties of pine are particularly desirable: Western yellow pine, jack pine, Norway pine (and, within their limits, Scotch pine, white pine, Austrian pine, etc.). The most desirable varieties of spruce are Colorado spruce, Black Hills spruce, white spruce (and, within limits, Norway spruce).

Forestry never attempts to appropriate agricultural soil, but seeks, rather, to make more profitable use of the poorer lands. If, however, agricultural land is not being economically used, or there is no immediate need for it, the farmer might well consider a farm forest crop, giving chief consideration to the commercially important and better species. Other tree species may often be worth while, considering their uses for game food and necessary game cover, as well as other factors that will have an important bearing on recreational and social uses.

When selecting trees to be left to grow for future returns, consider only trees that are thrifty and full of vigor, favoring the most valuable tree species that will grow into the commercial products desired. Timber

should be raised and handled as a crop, like any other crop on the farm.

Among the commercially important deciduous native forest trees, fairly fast growing important species include white birch, rock elm, red elm, soft maple, red maple, red oak, white and green ash, basswood, hickory, black cherry, walnut and butternut. The faster-growing conifers include white pine, Norway pine, jack pine, white spruce, and highland tamarack.

The most rapid-growing deciduous trees are aspen and willow families. What these rapid-growing trees lack in quality they make up for in quantity, and they are desirable for certain products such as excelsior, box boards, cheap lumber, pulpwood, and cordwood. For such uses they offer comparatively quick and satisfactory returns.

The slower-growing, more durable deciduous trees are yellow birch, sugar maple, white oak, black ash, and swamp tamarack. Among the slower-growing conifers are black spruce, cedar, and balsam fir.

# IV

# PLANTING

## TIME OF PLANTING

TREES should be planted when growth is dormant. Such seasons are in the spring, just as soon as the frost goes out of the ground and before spring growth begins, or in the autumn after growth has ceased. If trees are planted in the fall, sufficient time should be given before the ground freezes to permit the soil to become firm, moisture to accumulate, and roots to get set for winter needs. The exact time of spring or fall planting will vary with the region and the character of the seasons.

It is difficult to predict the kind of season following planting. Weather following planting operation will usually determine the later success or failure, other factors being equal.

During the spring period in Minnesota we usually have more rainy weather and better growing conditions. Spring planting is less chance-taking, more popular, and has proven more successful.

One disadvantage of fall planting is that drying winter winds combined with severe winter freezing have contributed greatly to fall and winter losses. If trees during fall planting are set out in wet soil the plants may be injured later by "heaving," as a result of alternate thawing and freezing of the ground.

Deciduous trees, especially, should not be planted when they are in leaf and still growing.

Dull, cloudy days are better planting days than hot, sunny, windy days, because during the latter tree roots dry out quickly. A good drizzly or cool, cloudy day is best for planting.

## PREPARATION FOR PLANTING

Good preparation of the planting area prior to planting is advisable. Under prairie conditions (where trees are not found naturally), it is necessary first to loosen the

soil by plowing or by putting the proposed planting site into some cultivated crop at least one year before trees are set out. The land should therefore be plowed deeply and surface soil should be kept loose and free of weeds through one growing season.

If trees are planted among thick high brush where it is not easy or practicable to plow, it often becomes necessary to clear out a space around each planting spot in order to give the trees a better opportunity to start growing. It is, of course, of paramount importance that any tree or area planted must be fenced off from all livestock.

If and when decisions are made as to what kind of trees to plant the order (if trees are purchased) should be placed with a reliable nurseryman at least two or three weeks in advance of planting time. It will be a distinct advantage to order long before planting time, ordering, if possible, the fall before for spring delivery.

### PREPARATION PRIOR TO PLANTING

Inspect planting stock thoroughly upon arrival, before receipt is given or before any payment is made. If the shipment is mutilated or in poor condition claim should be made against the transporting company. If the roots are dry, moldy, or the stock is not up to specifications notify the nursery company.

At no time, from arrival to actual planting, should the roots be allowed to become dry. Upon arrival open up the package and pour water over the roots before hauling the trees home; then re-cover, protecting against direct rays of the sun or drying winds. Evergreens are very sensitive and require the utmost protection and care. If they become dried ever so little they will not grow.

If it is not possible to plant the trees immediately, they may be placed temporarily in a trench dug in the ground, the roots and part of the stem well covered with soil to prevent drying out. This process is termed "heeling in." Trees should not be kept in this situation for very long, however. If they are to be held for a longer period (especially if the weather is dry), loose, cool, wet soil should be worked around the roots and then packed tightly and the area shaded and sheltered. Be careful not to cover any evergreen foliage with earth. Properly "heeled in" trees of any kind may be kept several days without loss or serious consequences.

## CARE WHILE PLANTING

When ready to plant small trees, half fill the pail which will be used to carry the trees, with a thin paste of mud and water. In this mixture the small roots are immersed to keep them from drying out during the planting process. When a tree is lifted out of the pail its roots must never be allowed to become dry.

Ordinarily the best tools to use in planting are spade or grub hoe, whichever ground conditions permit or require.

## PROCESS OF PLANTING

The number of people required to do a planting job properly depends upon the number of trees to be planted and the method used. Usually the organization consists

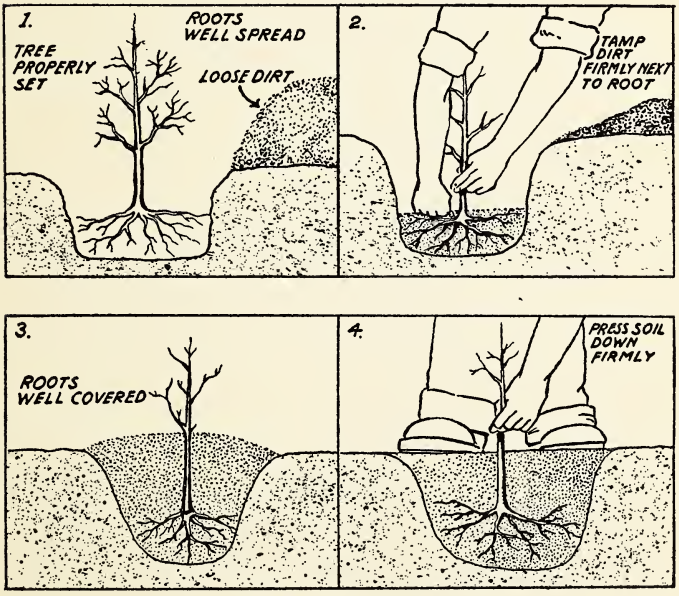



FIG. 3. HOLE METHOD OF PLANTING

of two-man crews, one man to make the openings and the planter who follows with the trees carried in a pail, the roots well covered with muddy water.

The hole for the tree should be deep enough and wide enough to permit the roots to be spread out well in a

normal position and to allow the tree to be set at about the same depth it formerly occupied.

The man digging the hole piles the loose dirt as close to the side of the hole as possible, in order to assist the planter. As the planter sifts the soil around the tree (which he holds in an upright position), he tamps the soil firmly from time to time so as to exclude all air spaces, getting the roots in direct contact with soil and thus preventing later drying out of the root system. Processes in the "hole method" of planting are shown in Figure 3.

Care should be taken during planting operations not to injure or "bark" the trees or injure the roots. Various methods of planting may be used, depending upon different situations and conditions, but the hole method is by far the best.

The rate of planting will depend on many factors, such as soil, size of trees, efficiency of labor, etc. Do not under any circumstances sacrifice good planting for speed. Careless planting is always expensive and disappointing in the end. Figure 4 shows improper methods.

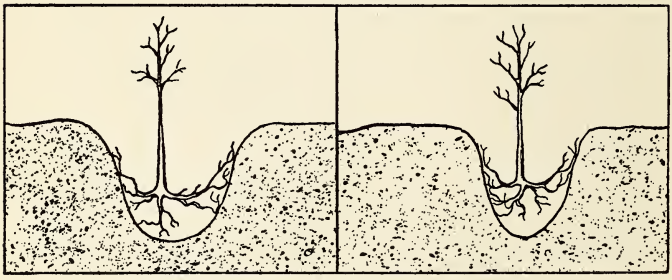


FIG. 4. IMPROPER METHODS OF PLANTING

The crown of a hardwood tree should be reduced or "cut back" before planting to compensate for loss of root system in moving, or, in other words, to balance the water and food absorption area with a corresponding reduction of the evaporating and food manufacturing active top.

In planting ornamental trees do not place them too close together. Bear in mind the fact that small, young trees will grow. For shade the usual spacing is from thirty to fifty feet apart, depending upon landscape plan and other factors. However, some trees, like evergreens, may be effectively grouped.

Overcrowding is undesirable in shade tree planting. It is the form of the individual tree and its proper relation to the rest of the landscape plan that brings out pleasing effects.

Do not plant trees in the middle of a lawn area. Put them at the side, to frame the picture. Beware of planting trees too close to the house, windows, or sidewalks.

If large trees are planted for shade purposes they should be supported by a stake driven into the ground, and the tree secured to the stake by means of wire covered with rubber hose or other material that will not chafe or injure the bark. As shade trees are usually larger than others the precautions graphically illustrated in Figure 5 are well worth observing.

The method of planting forest trees is the same as that which applies to other varieties. The proper interval between trees for planting for timber crops will depend

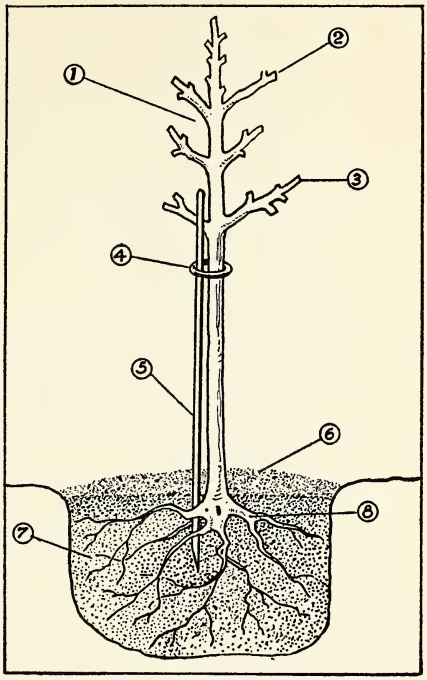



FIG. 5. IMPORTANT POINTS IN SHADE TREE PLANTING

1. Well-developed, symmetrical crown, main branches well and widely formed.
2. Properly pruned to check evaporation at start.
3. Lower branches not lower than 7 to 8 feet from ground.
4. Tied to stake with soft cloth or rubber hose.
5. Stake driven into ground at least 2 feet for support.
6. Mulch of pulverized earth; plenty of growing space free of grass and weeds.
7. Hole filled with rich earth, firmly packed about roots.
8. Sufficient fibrous roots; injured roots cut off.

chiefly on the habits of growth of the various species, soil condition, light, etc. The number of trees required to plant an acre at various spacings are as follows:

| | |
|---|---|
| 4 x 4 feet | — 2,722 trees per acre |
| 5 x 5 feet | — 1,742 trees per acre |
| 6 x 6 feet | — 1,210 trees per acre |
| 7 x 7 feet | — 890 trees per acre |
| 8 x 8 feet | — 680 trees per acre |
| 9 x 9 feet | — 538 trees per acre |
| 10 x 10 feet | — 435 trees per acre |

Best growth results can be expected from all tree plantings if the ground is kept open and porous by cultivation or working around base of tree the first year, to exclude weeds and grass.

All too often trees that are planted with a great deal of enthusiasm by individuals or public-spirited groups in the spring die on account of neglect before fall. Perhaps too much is expected in fast growth results the first year. Do not forget that the process of transplanting is quite a shock to the tree, and it must first have time to recover and to readjust itself before it can do its best. It must first re-grow roots lost during transplanting. It will therefore have to depend upon water within reach of its present root system for the first year or more. If trees seem to need water during the first summer, see to it that this is furnished at opportune times; but do not water so often as to encourage the growing of surface roots and constant dependance upon artificial aid.

## PLANTING CUTTINGS

*Cuttings* are portions of the branches or roots of trees which are capable of growing and forming new trees when properly planted. Poplar, cottonwoods, and willows are usually grown from cuttings.

When taking cuttings choose them from well-ripened wood of the previous year or a few years older. Such cuttings may be made any time after leaves drop or before growth starts in the spring. The best time in this country is perhaps early in March.

Cuttings should be made twelve to sixteen inches long and taken from smooth, healthy branches. They give best results when they are from about one-fourth to one inch in diameter. Make clean cuts with a sharp knife. Tie the cuttings in bundles to facilitate handling.

## Planting

If they are not to be planted immediately after cutting they may be covered with moist sand or soil in a cool place until ready for planting. If soaked in water twenty-four hours previous to planting they will absorb moisture which will aid them when set out. Set them out as early

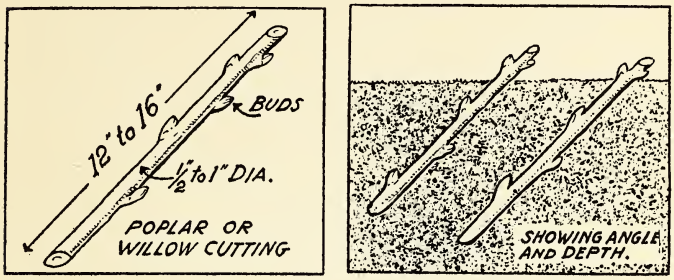



Fig. 6. Willow Cutting and Proper Method of Planting

as possible in loose, well-prepared soil.

In planting cuttings, make a slit in the soil at a 45 degree angle with a spade, and insert the cutting carefully, large end down. Leave only two buds above ground, the rest below. The second bud is a precaution only. If both buds grow, pinch off the weaker, directing growth into one dominant shoot. Firming the soil well around the lower end is very important. Figure 6 shows cutting and the proper method of planting. The buds below the ground will later form roots, while the one above will become the new stem, as shown in Figure 7. Never push the cuttings into the ground because in so doing you will break off the buds or tear and injure the bark which

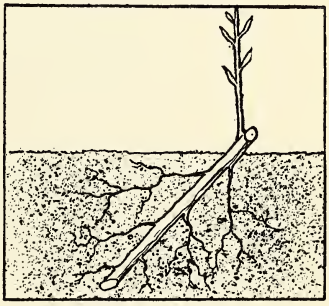


Fig. 7. Rooted Willow Cutting

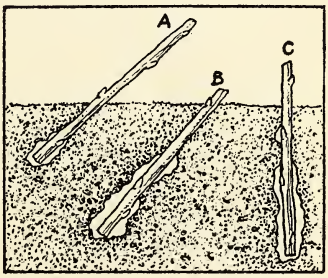



Fig. 8. Improperly Planted Cuttings

will result in probable failure. Figure 8 shows three improper plantings almost certain to lead to failure.

### TREE SEED

Some people are interested in collecting and planting tree seed, so the following brief information may be of value:

Time of ripening of tree seed varies with the different species, from early summer to the middle of September or October, depending of course, on climatic conditions and other factors.

A warm season will hasten ripening, and the reverse will be true if a dull, wet season precedes seed formation. Those interested in collecting seed should look up the various species discussed in this guide for the period of fruiting.

Examine tree seed you are going to collect from time to time. Seed should not be gathered before it is ripe. Seed of many species must be gathered from standing, upright trees, although it is sometimes possible to obtain seed from felled trees, cut during the seed-bearing period, while seed is still attached to the tree. (This is often possible in case of some evergreens.) Seed of nut trees and other species, of course, may often be gathered off the ground where they drop when ripe.

Seed of many species may be sown or stored in same condition as they are gathered without any additional treatment, except cleaning. Fleshy seed from trees like cherry, plum, etc., should be dried in the sun before storing, or the fleshy coat removed and seed stored in moist sand over winter (stratified) and planted the following spring.

Do not collect seed from stunted, diseased or sickly trees. Seed from such trees will continue the characteristics of the parent tree. Seed from too young trees is usually poorly developed and will not sprout well. If possible, confine seed collecting to mature, vigorous trees.

Seed on open grown trees usually matures earlier than seed found on trees in close shaded stands. Seed of evergreens or conifers are borne in cones. On examining a fresh cone it will be found to be made up of woody scales attached to a central axis. At the base of the cone scales will be found small seeds in pairs, each having attached a delicate papery wing, which helps in dissemination when the cone opens up on the tree and liberates the

ripened seed. Seed from cone trees must be taken, however, before the cones open and seed is lost. Dry open cones found lying on the ground are of no value.

Any seed which is to be stored over winter must not be allowed to dry out. It is well to keep the seed in a cool place where moisture in the air is fairly constant. Damp cellars are not good, nor dry furnace rooms. Glass fruit jars and tin receptacles having tight fitting lids make good storage containers. Seed of elm, etc., should not be stored but sown as soon as gathered in the spring.

The collecting of various tree seeds has become quite a business on many farms in various sections of Minnesota. It is an occupation the whole family can take part in and one that may often yield an extra income at a time of year when work is not pressing on the farm. In some sections of the state, collecting seed for sale to nursery companies, government and state agencies, thus utilizing a crop that has in the past seemed worthless, may help pay taxes.

Trees required for idle land can be grown in a garden patch from seed and later planted in permanent locations. Many farm boys and girls are raising their own trees for home planting projects, such as for windbreaks, woodlots, game cover, and soil erosion projects.

# V

# THE CARE OF TREES

GRAZING animals, hogs, and even chickens should be rigorously excluded from all plantings. Even if the trees are too large to be broken or straddled and the bark eaten, branches are browsed, and necessary ground cover, such as leaf mold and forest litter, which add to soil richness and moisture-holding factors, is destroyed. Even if the animals do no browsing, the trampling of the soil and injury to roots often result in the early death of the tree. Severely trampled soil becomes nearly impervious to moisture. Chickens scratch around the base of small trees, scoop out depressions to dust themselves, and expose the roots (particularly of evergreens) and this, too, frequently causes poor growth or death.

Watch out for harmful insects and tree diseases that may injure or jeopardize the planting. If noted in time these dangers can ordinarily be checked. Dead, dying, and weakened trees breed and attract injurious insects. In the case of shade and ornamental trees, most insects and many diseases can be controlled by spraying.

## INSECTS

Many trees and shrubs are subjected to attack by many forms of insect life during their growing period.

The first step in protection is to use proper precautions during the initial planting period. Examination of tree material prior to planting is the first preventive step; any insects found on the stock should be destroyed before they get a chance to develop, cause further injury, increase, and spread to healthy planting material.

Some trees are more susceptible to insect attack than others. Where choice in selection is possible, this fact should be considered prior to purchase or planting. A few species such as soft maple, poplar, box elder, and certain willows seem to draw insect attraction.

## Tree Insects

Trees which are to be planted should be healthy, disease-free, and have a vigorous, well-developed root system. For this reason nursery grown trees are preferred over those taken from native woods.

The first few years of growth and wise care will determine future tree success. A healthy tree, properly planted, guarded against injury and insect attack, provided with adequate moisture and soil fertility, will assure the owner results desired in the future.

It is not possible to discuss in this small book the many different species of insects that damage or kill trees. For brief, practical advice, however, insects have been divided into broad, general classes to facilitate general identification and to offer general control measures.

In general, most of the injury caused by insects is done by the younger offspring, hatched most often from eggs deposited by the adults. In some forms, as in the case of plant lice *(aphids),* the immature stages differ very little from the adult stages. In a majority of other insect forms, however, the young, or *larvae,* differ a great deal from the adult stages. Some of the forms commonly recognized are the so-called caterpillars, grubs, maggots, slugs, etc. Any one of these forms may do considerable damage, and during the early stages may be advantageously fought and controlled. The control of a specific insect may best be waged if its life history and feeding habits are better known. The manner of injury or feeding habits of the insects will throw specific light on methods to be employed in general control.

### LEAF-EATING INSECTS

The feeding habits of the large group of leaf-eating insects are usually easily identified and offer a guide to the remedy to be employed. A few insects in this general group are the caterpillars, slugs, beetles, grasshoppers, etc., which feed upon the foliage of plants, taking the chewed material into their stomachs.

Such insects can be destroyed through the use of stomach poisons put upon the foliage of the plants. Stomach poisons affect those insects having chewing mouth parts. The most common poison employed for this type of control is arsenate of lead. This is usually applied as a spray but may often be dusted on the leaf surfaces as a powder. When used as a spray, 1½ pounds of arsenate of lead powder material is mixed with 50

gallons of water, or nine level teaspoons to a gallon of water. At this strength it is adequate for averaged-sized leaf-chewing insects. Other effective stomach poisons are Paris green, arsenate of lime, etc. Being poisonous these substances should be handled with care and not left where livestock or children can get to them.

### SUCKING INSECTS

Injury caused by sucking insects is not evident by holes or chunks taken out of the foliage, but rather by leaf discoloration, wilting of the leaves, and the sickly appearance of the tree. Sucking insects do not eat the foliage but feed on the juices contained in it, sticking their "beaks" through the epidermis (skin) of the leaves, and sucking the juice contained therein in the same manner as mosquitoes suck blood through human skin. Poisons put on the leaves, therefore, do not affect them; they must be killed by means of contact sprays, sprays that come in direct contact with their bodies.

In this group of insects we find plant lice (*aphids*), scale bugs, slugs, leaf hoppers, etc.

Control measures include the use of such material as various soaps and water, lime-sulphur, nicotine sulphate, kerosene emulsion, miscible oils, etc. Kerosene emulsion and soap solutions may be prepared at home while the others mentioned may be purchased and proper dilution directions followed.

### SCALE INSECTS

Scale insects get their name from the scale that covers the backs of most of them. The outer covering may be hard, waxy, or cottony, depending upon the specie of scale insect and color. There are many forms of these insects, but they are all plant feeders. Some confine themselves to a single species of plant, while others are active on a great variety of plants, being found on stem, branches, twigs, leaves, and even on fruit.

These insects feed on sap or juice which they get by sticking their sharp beaks through the plant tissue. Generally speaking, they may be considered as sucking insects. They are also combated with sprays.

The best time for the control of these insects is when trees are dormant because at that period there is no delicate foliage to injure and none to hide the insects. Spraying with lime-sulphur, miscible oils, fish oil solutions, and kerosene emulsion are effective.

## BORERS

Insects of this class are usually the larvae (young) of beetles or even moths. These larvae usually attack only sickly trees that have been weakened or injured. Some larvae in this large group, however, may also attack healthy and thrifty trees.

Borers are hard to fight against because they spend most of their lives in the trees (under the bark) and so are hard to reach. Some borers work in the terminal shoots, but most work in the healthy tissue under the bark, girdling, tunneling, and boring, which eventually results in the death of the tree.

Various rots gain entrance through the injuries caused by borers, and their presence is often not noticed until it is too late to save the trees. The presence of borers is often indicated by small piles of sawdust next to their entrances or at the base of the tree.

Before adopting specific control measures for the various species of borers, which may include round and flat-headed borers and bark beetles, the specie must first be identified and the life history and life cycle understood.

The first step in general control of borers is prevention, keeping trees healthy by seeing that they have good growing conditions and adequate protection against fire and injury. Valuable trees are treated by the injection of carbon bisulphide into the small holes made by the borers and the sealing of the holes. The gas generated by the bisulphide finally kills the larvae. This method is rather expensive, however. If borers are found in great numbers the only solution is to cut out and dispose of the infested trees to prevent further spread to healthy trees.

## GALLS

Galls are often noted on limbs, leaves, or twigs. These are abnormal growths caused by certain insect injury or attack. Sometimes these galls take on peculiar or grotesque development, caused by injury or stimulus to plant tissue and cells as a result of insect activity or excretion. The type of gall present quite specifically identifies the kind of gall insect working. Galls are often not particularly harmful except in a few cases. Some species of trees are more susceptible to gall injury than others. Where expense warrants, spraying may be resorted to. Spray the infested trees during the dormant period with

a contact solution like kerosene emulsion or miscible oil solution. Where only a few galls occur they may be picked off and destroyed.

## TREE SURGERY AND WOUNDS

The matter of pruning and tree surgery is a broad subject and can be studied extensively only through the use of reference books and bulletins dealing specifically with the subject. However, a few suggestions will no doubt be found helpful.

"Tree doctoring" has received considerable attention during the past few years, and while tree surgery is often helpful, it must not be carried to extremes or considered a cure-all.

When tree surgery is undertaken the work must be done only with a full understanding of facts pertaining to causes of injury, be they disease, insect, or mechanical, and with the results to be accomplished thoroughly understood. Work of this type should under no circumstances be delegated unless the persons doing the job are fully responsible and qualified or who have behind them reputable firms qualified to do work of this kind or who furnish proper supervision.

Many "cure-all" treatments such as the injection of mysterious medicines into the roots or trunk of the tree are advocated by "tree healers." To my knowledge there are no cases where broad claims have been proven or even helpful.

The object of general pruning is to shape and improve the form, size, and general health and strength of the tree. Such steps, however, should not be entrusted to any workman who happens to have a saw, axe, or knife at his disposal. Without proper knowledge pruning may result in tree butchering and malformation.

It is best to prune trees early in life; it can be done easiest then, and the form of the mature tree can be better guided. In the words of the old saying, "as the twig is bent, so is the tree inclined."

Broken, decayed, diseased branches should be taken care of as soon as the disease or injury is noted.

The best time for the removal of live limbs is during the dormant season, since the tree suffers less and "bleeds" less at that time than at any other period.

In pruning large branches, they should be cut in such a manner as not to split or cause injury. In cutting off large limbs, a cut is first made on the underside half way through close to the tree and a cut then made on the upper side. This practice avoids the danger of the heavy branch tearing loose and stripping the bark of the main trunk, causing additional injury.

Careless pruning does much to shorten the life of the tree, leaving rotten stubs or torn bark which serve as starting places for disease.

Snow, sleet and wind breakage can be lessened by removing soft, brittle branches or those weakened by decay or disease. When pruning is done, do a clean, smooth job and treat wounds at once.

All wounds should be dressed by the application of good paint, shellac, or tar in order to keep out spores (seed), rot, or wood destroying fungi.

If a rotten cavity is cleaned out it should be treated with a fungicide, painted, and filled. Cement is often used for filling but this is not always entirely satisfactory as it gives only rigidity but no healing powers. The use of asphaltum with sawdust and other mixtures is now in more general use. Treating cavities should not be entrusted to amateurs.

Pruning is often not necessary under forest conditions, as the crowding of the trees results in natural pruning or killing off of unnecessary limbs. In some instances, however, Nature works slowly, so that lower branches, which have been killed through shading, persist on the trees for a good many years. Pruning in the timber stand is then resorted to in order to remove some of these dead and even some of the unnecessary living branches, thus aiding future growth.

The danger of fire and injury resulting therefrom is so obvious that there should be no need to discuss it in any detail here. Even a slight ground fire moving slowly through the trees which seemingly does little tree injury, does destroy leaf mold, ground cover and humus that is so important and vital to the future needs of the plantation. *Fire is the tree's worst enemy.*

When loss of planted trees is sustained, make provisions for early replacement. "Gaps" should be filled in within a few years so as to insure a continuous, uniform future stand.

# PART II

# COMMON FOREST TREES OF MINNESOTA AND THE LAKE STATES

# VI

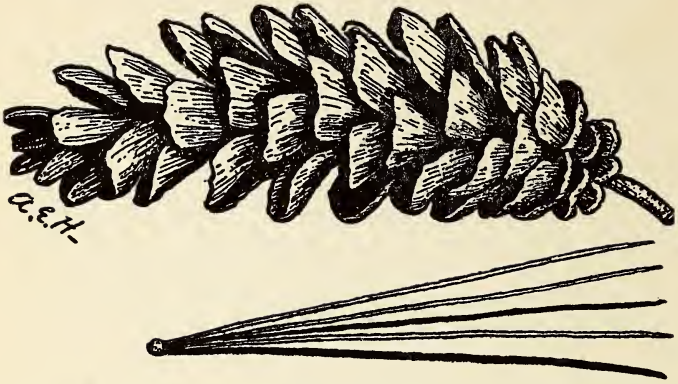
## THE NAMES OF TREES

THE fact that all trees have both common and scientific names has no doubt puzzled many people. For example, the tree commonly known as White Pine is scientifically known as *Pinus strobus.* All scientific names consist of two parts, the first, corresponding to a surname, referring to the genus or family to which the tree belongs, and the second referring to a specific tree in that family. Thus *Pinus* identifies a tree as belonging to the Pine family and the specific name following, *strobus, resinosa, banksiana,* etc., identifies the particular tree as being White Pine, Red Pine, or Jack Pine. Scientific names are always in Latin and therefore are the same the world over, thus avoiding confusion resulting from the fact that common names of trees differ greatly in different regions and localities. In many cases, even in the same region, a tree is known by more than one name. In the following catalog, therefore, local, regional, or trade names of trees are given in parenthesis immediately after the most common name. The initials or abbreviations following the scientific name refer to the botanist who first made complete identification and classification of the tree described.

Distinguishing tree families and individual trees from one another is best done by description of the form, leaves, fruit, bark, uses, and range of the various trees, together with illustrations showing the outstanding characteristics. This method has been used in the descriptions which follow, and the trees are described in order by families. Through these descriptions in simple, non-technical terms, with distinguishing characteristics stressed and illustrated, it is hoped that many tree lovers will find a guiding hand leading to a greater knowledge of tree families and specific trees.

## WHITE PINE
(*Pinus strobus* L.)

HABIT—One of the tallest conifers in Minnesota. Straight trunk, regular pyramidal shape with soft gray-green foliage. Growing under forest conditions in dense stands, trees have straight trunks usually free of branches for many feet, and small crowns. Found growing in the



WHITE PINE
Two-thirds natural size

open, however, the crown is quite large, unbalanced, broadly conical, with branches which persist well down to ground.

On young trees the branches extend horizontally in whorls, i. e., arranged in definite circles around the stem, marking quite definitely successive years of upward growth.

In Itasca Park and elsewhere in Minnesota, large white pine may be found 130 feet or higher and up to 44 inches in diameter.

LEAVES—Needles 3 to 5 inches long, occurring in bundles of five, distinguishing white pine from all other pines in Minnesota; bluish-green on upper surface, whitish beneath. Leaves fall at end of second and during the third season. Flowers appear in May.

FRUIT—A downward hanging, cylindrical green cone, 4 to 6 inches long, attached by means of a fairly long stalk. Cone requires two years to mature, reaching full size during July or early August of second year, turning brown when ripe, and opening about the middle of Sep-

tember. Two-winged seeds at the base of each cone scale.

Bark—Thin, smooth, and greenish-gray on young trees; thick, grayish-brown, and deeply furrowed on older trees. It is often used for medicinal purposes.

Wood and Uses—Light, soft, compact, straight grained, light brown in color, often tinged with red, and with numerous resin ducts. Sapwood is light colored; heartwood, light brown.

It is strong for weight, takes paint well, does not warp easily, and is easily worked.

White pine lumber is in great demand for construction purposes, boxes, cabinets, matches, sashes, doors, etc.

One of the most commercially important trees of the Lake States, growing rapidly on soils to which it is best suited. It is, perhaps, the most graceful of our evergreens and is, therefore, much used in ornamental planting.

Range—Found scattered as individuals but often growing in solid stands in northern, central, and eastern parts of Minnesota. It may also be found scattered along the Mississippi River as far south as Houston County, and the valleys and river bluffs along the St. Croix River.

Prefers light, fertile loam. More often found growing on clayey land. Not suitable to dry places. Fairly tolerant.

## NORWAY PINE (Red Pine)

(*Pinus resinosa* Ait.)

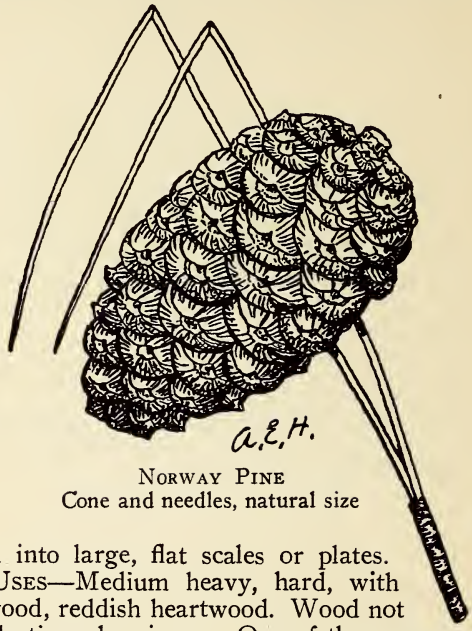
Habit—A handsome tree, growing straight and tall, reaching to a height of 100 to 110 feet and a diameter of 30 to 40 inches. Fine, clear stands are noted in Itasca Park, Cass Lake, Red Lake, as well as in forest areas of Cook, Lake, St. Louis and Itasca Counties. Its rate of growth is comparable to white pine, but it is suited to planting on drier situations.

The name Norway pine has nothing to do with its being found in Norway. It is not found native in Norway or in any other part of Europe.

It may be planted in pure or mixed stands. Growing under forest conditions, the trunk is clear, straight, and free of branches. The crown of older trees is a round-topped head, with stout, thick-spreading branches.

Leaves—Needles 4 to 6 inches long, occurring in clusters of two, each pair surrounded at base by persistent, scaly sheath; dark green in color, soft and slender. Leaves fall during fourth and fifth seasons.

Fruit—An ovate, conical cone, about 2 inches long which attains full size during the second summer. When immature, color is orange, turning to light reddish-brown when ripe about the middle of September. Cone scales are free from resin. Cones persist on branches after ripening (after seed disseminated) until following spring. Two-winged seeds are found at base of each cone scale; dark chestnut brown in color. Prolific seeder. Seed requires about two weeks to germinate.




Norway Pine
Cone and needles, natural size

Bark—Mature bark reddish-brown, becoming divided into large, flat scales or plates.

Wood and Uses—Medium heavy, hard, with thin whitish sapwood, reddish heartwood. Wood not very strong but elastic and resinous. One of the commercially important timber trees found in Minnesota and the lake states. Harder than white pine and used for same general purposes.

It is also of ornamental value and is used extensively in windbreak and shelter-belt planting. Will thrive on dry, gravelly and sandy sites. Rarely found on low ground. May be planted pure or in mixed stands.

Range—Reaches its greatest development in northeastern portion of Minnesota. Range about same as white pine in Canada and northern states as far as Pennsylvania.

## JACK PINE
(*Pinus banksiana* Lamb.)

HABIT—Usually a small tree ranging in height from around 30 to 35 feet with a trunk diameter at maturity usually around 8 to 15 inches. Species have been found reaching a height of 90 feet under very favorable circumstances. A tree of large, spreading, persistent branches, with short needles. Gnarly, scraggly specimens are common to poor soils.

Usually the first pine to come in after a fire. It is hardy, grows rapidly even under unfavorable circumstances, making good growth on soils too poor for other pine.

Head pyramidal, has a habit of forming several whorls of branches on the new growth. Very tolerant and may be planted in pure, dense, or mixed stands.

JACK PINE
Three-fourths natural size

LEAVES — Needles, fairly flat and rigid, about 1 inch long, occurring in pairs, each pair surrounded at base by short, persistent sheath; dark green in color, usually curved and twisted. Leaves persist 2 to 3 years.

FRUIT—Cone about 2 inches long, curved, oblong, conical in shape, light brown in color fading to gray as cone matures. Cone scales are without spines and free from resin. Cones occur laterally on branches, often in pairs, reaching full size the second autumn and remain closed for several years, persisting on the tree. Seed small, winged; dark brown in color. Cones may be obtained any season of the year; even old unopened cones seem to have seed of high vitality.

BARK—Mature bark dark brown to grayish; thin, divided irregularly into narrow, rounded ridges, scaly on the surface.

WOOD AND USES—Medium heavy, hard, pale brown to orange in color, with thick, white sapwood. Resinous

and knotty. Least valuable of native pines. It is used for windbreak and forest plantings and is of economic importance because of its ability to grow under unfavorable conditions of soil and moisture.

Occasionally manufactured into lumber, often into ties, posts, box material, kraft paper, pulpwood, cordwood. Large trees sawed into lumber, often pass for Norway pine. Of little ornamental value, but very useful in windbreak planting or growing tree crops on sandy soils.

RANGE—Found growing in solid and in mixed stands in north-central and northeastern Minnesota. Found also in northern New England and St. Lawrence Valley and north to Arctic Circle. Will grow in very dry sterile soil.

## WHITE SPRUCE

(*Picea glauca* Voss.)

HABIT—A tree attaining on good sites a height of 100 feet and a diameter of 2 feet, but usually smaller.

WHITE SPRUCE
Branchlet and cone, natural size

A graceful tree of pyramidal habit, consisting of long, rather stout, up-curving branches. Trunk straight. Often found in pure stands, or mixed with pine and hardwoods on drier soils, and with balsam and tamarack on moist soils. Very tolerant; will stand close planting.

LEAVES—Four-sided, awl-shaped needles, ½ to ¾ inch long, crowded along branchlets in dense spirals, those on underside appearing to curve upward; bright green when young, turning to bluish-green when older. Slightly disagreeable

odor when crushed. Fall gradually after several years.

FRUIT—Oblong, cylindrical cone about 2 inches long. Cone scales rounded at their ends, soft, very thin and flexible when mature. Seed matures in one season, attaining full maturity by middle of summer, ripening early fall, at which time cone is a pale, shiny brown color. Cones fall after seed has been set free. Seeds small, brown, winged.

BARK—Mature bark, gray tinged with brown, scaly; twigs light brown.

WOOD AND USES—Light, strong, soft, straight-grained, light yellow in color; sapwood scarcely distinguishable from heartwood.

Used for lumber, extensively for paper pulp, airplanes, canoe paddles, sounding boards. Widely used in ornamental planting and for windbreak, shelter belt, game cover, and Christmas tree plantings.

RANGE—Found extensively in forests of northern Minnesota and southward into St. Croix Valley, and Lake States region. It is found generally from northern Maine westward to parts of Montana and north to Alaska. On dry soils associated with pines and on better soils with hardwoods. It reaches its best development on fairly moist, fertile soils but will grow in quite dry sites.

## BLACK SPRUCE

*(Picea mariana* B., S., and B.*)*

HABIT—Usually a small tree of rather slow growth, with straight trunk, sometimes reaching a height of 50 to 65 feet. Found mostly in wet, cold swamps. Crown narrow and pyramidal, irregular, fairly open. Short drooping branches that curve upward at the ends. Branches are persistent; those near the bottom when coming in contact with soil may take root (layering), sending up shoots. In cold muskeg situations, growth is exceedingly slow, 127-year-old trees having been found 3 to 4 feet high and 2 inches in diameter; but on sites where growing conditions are favorable it will make nearly as good a growth as white spruce. Old trees have spire-like crown.

LEAVES—Faintly hairy, short, pointed, four-sided needles about ½ inch long, scattered thickly over branches; bluish-green in color. Leaves fairly persistent, falling gradually after a number of years.

Fruit—Purplish, small oval cone, ¼ to ½ inch long, remaining on the tree many years. Cone scales thin, rounded with uneven margins, grayish-brown in color. Seed dark brown in color, small, with rigid wings.

Bark—Dark, grayish-brown, scaly, thin.

Wood and Uses—Yellow-white in color, light, soft, weak. Sapwood thin. This tree should not be used for

Black Spruce
Branchlet and cone, one-half natural size

ornamental planting or on dry situations. Used extensively for Christmas trees.

Rarely sawed into lumber but extensively used in manufacture of paper pulp and forms dense stands of valuable pulp forests. When used as lumber, it finds same use as white spruce. Resinous exudation from the trunk is often gathered for "spruce gum."

Range—Native of the northern "muskeg" or "bog" territory of North America. In Minnesota mostly confined to northeastern and north-central portions of the state.

## TAMARACK (Larch)
## (*Larix laricina* K. Koch)

Habit—A slender, graceful tree usually 30 to 35 feet high with diameter 10 to 24 inches, but under favorable conditions sometimes reaching 70 feet. Large trees are rare because of depredations on this specie of larch saw-fly.

The crown in young trees is narrow and pyramidal. In older trees, growing in more open light, the head is

broad and fairly open; the trunk straight and upright with slender, spreading branches, turning slightly upward. Crown has feathery appearance with new green foliage in spring and summer. *The tamarack is a cone-bearing tree but deciduous.*

LEAVES—Slender needles, ½ to ¾ inch in length, triangular in cross section, borne in clusters on spur-like branches and distributed singly in terminal shoots; pale, bluish-green in spring, soft and flexible. Leaves are shed in fall, at which time they turn yellowish-brown. This is our only deciduous conifer.

TAMARACK
Three-fourths natural size

FRUIT—Small cones ⅖ of an inch wide and ¾ of an inch long, nearly spherical. Before ripe, purplish-red in color, changing to light brown when ripe. Cones borne on stout, short, incurved stalk. Open cones can be noted persisting on the twigs for a year or two. Seeds winged, light brown in color.

BARK—Mature bark thin, separating into reddish-brown scales.

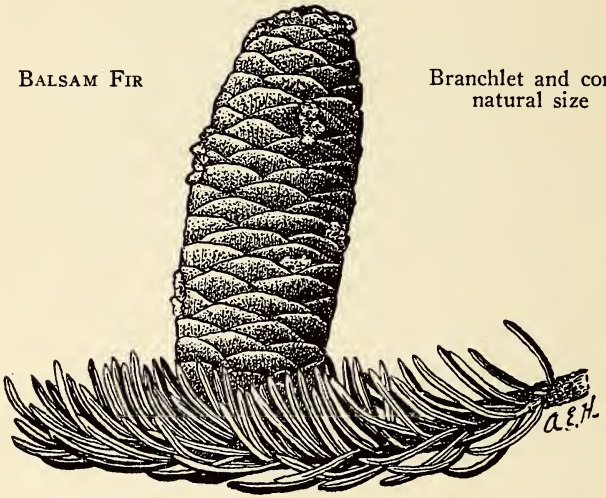
WOOD AND USES—Yellowish-brown, hard, heavy, strong, durable in contact with soil, resinous; sapwood nearly white. Used for fence posts, poles, ties, well cribbing, lumber, fuel, kraft paper. Tamarack is hardy and makes good growth on high land but is not as graceful or ornamental as the European larch.

RANGE—Found chiefly in swampy lowlands in northern and central Minnesota and northern states region and nearly to Arctic Circle. When found on drier, favorable sites, it reaches good size. Usually found associated with spruce, cedar, and other lowland hardwoods, such as yellow birch, maple, elm, willow, and aspen.

## BALSAM FIR (Balsam)
(*Abies balsamea* Mill.)

HABIT—A tree of medium size, 40 to 80 feet high, with a trunk diameter of from 9 to 20 inches. Young trees growing in the open have open, pyramidal crown, with broad base, slender, horizontal branches occurring in distinct whorls of 4 to 5. Under crowded conditions in forest, lower branches die, leaving a reduced spire-like crown.

BALSAM FIR



Branchlet and cone, natural size

LEAVES—Needle-like but blunt, flat, appear to be in two-ranked arrangement, ½ to ¾ inch long, spreading at right angles to the twig; dark green and shiny above but with two white shiny lines on under side. Leaves fall during the fifth season.

FRUIT—Cone 2½ to 4 inches long, borne in an upright position on branch, violet in color, bearing globules of resin. Cones mature autumn of first year. When ripe, cone-scales fall away, leaving the bare central axis standing upright on the branch, like a spike. Seed brown, winged.

BARK—On young trees, bark pale gray, thin, smooth, prominently raised at various points by "blisters" containing resin or balsam pitch. Mature bark reddish-brown, separating into small, irregular scaly plates.

## Balsam Fir, Red Cedar

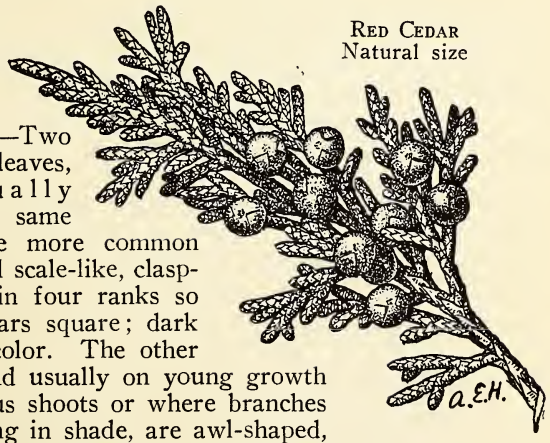
Wood and Uses—Whitish, tinged with yellow, reddish toward heart. Light, soft, coarse-grained, not strong. Of little value as source of lumber but occasionally used. Resin furnishes aromatic Canadian balsam oil. Fragrant new leaf growth in spring, used to stuff small pillows.

Balsam wood is mixed with spruce for paper pulp. This tree finds ready market during holiday season for decorative purposes. Has been used for ornamental planting, but should be sparingly used, if at all, on account of moisture and shade requirements.

Range—Confined principally to northeastern and north-central Minnesota and a few scattered localities in southeastern part of the state. In north states region found growing in cool lowlands, damp woods, associated with spruce.

### RED CEDAR (Juniper)
### (*Juniperus virginiana* L.)

Habit—A rather small tree, reaching a height of 25 to 30 feet and diameter of 9 to 16 inches; usually smaller. When growing on good sites the trunk is straight, crown narrow, compact, rounded, consisting of short slender branches. On poor, rocky, dry locations, the trunk is often divided, the tree showing stubby, nearly prostrate growth.




Red Cedar
Natural size

Leaves—Two kinds of leaves, both usually found on same tree. The more common kind, small scale-like, clasping stem in four ranks so stem appears square; dark green in color. The other kind, found usually on young growth on vigorous shoots or where branches are growing in shade, are awl-shaped, sharp-pointed, spreading. First described leaves most common. Leaves aromatic and resinous, turning brown in winter. Cedar holds its leaves 4 to 6 years.

Fruit—Fleshy, berry-like, seed. Before mature, seed is green in color, turning purplish with a white bloom when ripe in autumn. Usually two seeds surrounded by sweet fleshy covering, relished by birds and widely distributed by them. Favorite winter food of many birds.

Bark—Thin, light brown, sometimes peeling off in long, narrow, fibrous strips. Bark on twigs greenish to red-brown and smooth.

Wood and Uses—Aromatic, soft, strong and of even texture. Durable in contact with soil. Heartwood decidedly purplish-red, sapwood yellowish-white—a color combination that makes striking effects when used in the manufacture of cedar chests, closets, and interior woodwork. Used also for fence posts, pails, tubs, lead pencils.

Juniper berries used for medicinal purposes and liquor. Tree hardy and often planted ornamentally and in dry situations for windbreaks. Do not plant near apple orchard as it is a host plant of apple rust.

Range—Found in dry, gravelly regions or on barren, rocky hillsides of uplands and along river bluffs. Has a wide distribution through Minnesota and North America.

## WHITE CEDAR (Arbor Vitae)
(*Thuja occidentalis* L.)

Habit—An evergreen usually of symmetrical, pyramidal form. Under good growing conditions sometimes reaches height of 70 feet and a diameter of 2 to 3 feet. Tree has short, horizontal branches which form a narrow, conical, dense crown. In the open trunk is short, branches often extending nearly to ground. Under certain growing conditions trunk may be buttressed, twisted, and divided into several upright secondary stems. Even under shaded forest conditions dead branches are very persistent. There are many ornamental garden varieties of the arbor vitae. "Winterkills" are frequent in ornamental planting because of lack of moisture in winter due to dry falls. Should be planted in sheltered locations and moist, rich, situations for best results. Will stand considerable pruning.

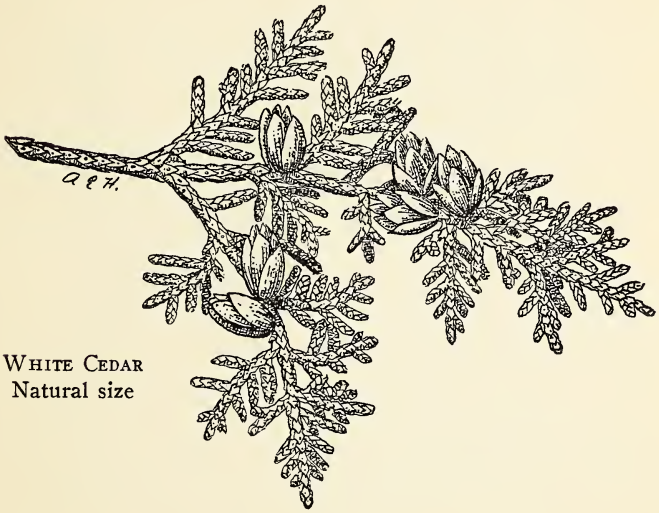
Leaves—Opposite, scale-like, one-eighth to one-fifth of an inch long, and so arranged that small branches are flat. The leaves are yellowish-green and have a pleasant, aromatic odor when crushed and a pungent taste.

Fruit—A small, oblong, erect green cone, ripening to cinnamon brown the first autumn. After seed is gone,

empty cones persist during following winter. Seed light brown about one-eighth of an inch long, encircled by broad wing.

Bark—Grayish to reddish-brown, thin, fibrous; on old trunks separating vertically in narrow, shreddy strips.

Wood and Uses—Light, soft, brittle, coarse-grained, very durable; fragrant; light yellowish-brown. Thin, very white sapwood. Used for fence posts, telephone poles, ties, shingles, canoes, paddles, boats. Also used in ornamental plantings and for hedges. A tincture is often made from young branches as treatment for fevers, colds, etc.




White Cedar
Natural size

Range—Nova Scotia west to Manitoba, Valley of the St. Lawrence and border states to lake states, south to parts of Georgia and Tennessee. In Minnesota grows abundantly in low, swampy ground in northern pine region where it usually forms dense thickets in areas called "cedar swamps." May sometimes be found growing on barren rocks, or along water courses, singly or in clumps, as far south as Winona County.

## BLACK WALNUT
(*Juglans nigra* L.)

HABIT—A valuable, handsome forest tree. On fertile, moist situations, frequently attains height of 100 feet and diameter of 3 to 5 feet with a straight trunk, clear of branches for over half its height. Has long taproots, with few lateral roots, and for this reason does not transplant easily, except when very young. Crown broad, round-topped, with stout spreading limbs. In open, trees short-stemmed, round, broad, spreading crown, casting dense shade.

BLACK WALNUT
Twig, three-fourths; leaf and fruit, one-fifth natural size

LEAVES—Alternate on stem, compound, 1 to 2 feet long, consisting of 7 to 11 pairs of leaflets, terminal leaflet often shorter or suppressed. Leaves taper-pointed, toothed along outer margins, except at base; color yellowish-green, shiny above, softer and slightly hairy below, turning yellow in fall before they are shed. Aromatic when crushed. Twigs stout, pith brown, chambered.

FRUIT—Large, round, four-celled. Sweet, oily, edible nut with deeply furrowed brown shell, surrounded by thick yellowish-green husk covering, roughened and slightly hairy. Nuts borne singly or in clusters of 2 to 3. Fruit matures in fall.

BARK—On new growth, bark, dark brown, smooth, shiny. Mature bark, dark brown to gray-black, divided by deep fissures into broad, rounded ridges.

WOOD AND USES—Heavy, hard, strong, somewhat coarse-grained, easily worked. Heartwood of superior

quality and commercial value. Color of wood rich dark brown with thin, lighter sapwood. A valuable, important tree, desired for special exacting uses: furniture, cabinets, interior finish, airplane propellers, gun stocks, etc. Quite durable in contact with soil; formerly used for rails and fencing. Finest veneers are made from burls and roots. A fine ornamental tree; also planted for forest purposes in its range, for the value of lumber and for the nut crop.

Range—Central New England, lake states to southern Minnesota, eastern Kansas, south to Florida and eastern Texas. In Minnesota found in southeastern and south-central sections. Prefers rich, moist, well-drained bottom lands and fertile hillsides.

## BUTTERNUT (White Walnut)

(*Juglans cinerea* L.)

Habit—A smaller tree than black walnut but may sometimes reach height of 80 feet and diameter of 3 feet. Usually a medium-sized tree with short, stout trunk that often divides. In open, forms a large spreading crown which is round-topped, broad, fairly open.

Butternut

Leaf, one-fifth; twig, one-half; fruit one-third natural size

Leaves—Alternate, arranged in pairs, 15 to 30 inches long, each with 11 to 17 leaflets, lance-shaped and finely-toothed on outer edges; yellowish-green above, paler and

hairy underneath. Petiole of leaf stout, hairy, clammy. Leaves turn yellow or brown, falling in autumn.

FRUIT—A nut enclosed in an oblong, somewhat pointed, fleshy, sticky, yellowish-green husk of rather pleasant odor. Fruit borne singly, often in drooping clusters of 3 to 5. Nut shell deeply furrowed with rough, ragged edges. Meat sweet, edible, rich in oil. Nuts ripen in fall.

BARK—Light gray on branches and trunk of small trees, darker on older trees, divided by narrow ridges, wide furrows. Pith in twigs dark brown, chambered with cross partitions.

WOOD AND USES—Light, soft, weak, coarse-grained, light brown in color, sapwood light-colored. Wood takes a good polish and is easily worked. Not an important timber tree but used much the same as walnut. Lumber sold often under name of white walnut. The bark and the husk of nuts contains a dye used in coloring cloth yellow or an orange color. Sugar of good quality can be made from sap. Used for ornamental planting and shade trees.

RANGE—Maine, St. Lawrence Valley to lake states and eastern Dakotas, south to northern Georgia and northeastern Arkansas. In Minnesota found about same range as walnut, but extending further north to Aitkin County. Makes its best growth in rich woods and hillsides.

## SHAGBARK HICKORY (Shellbark Hickory)

(*Hicoria ovata* Britton) (*Carya ovata* K. Koch)

HABIT—A large tree averaging 60 to 100 feet high and 2 to 2½ feet in diameter on very good sites. Crown usually irregular and open; trunk usually forking into stout ascending branches. Through competition growing in woods, trunk straight, often free of branches for quite some distance, with a narrow crown. Sturdy, beautiful tree.

LEAVES—Alternate on stem, compound, 8 to 15 inches long, and composed of 5, rarely 7, leaflets arranged along a stout, hairy, slightly-grooved petiole. Leaves firm; dark yellowish-green above, shiny, paler underneath. Foliage fragrant when crushed.

FRUIT—Nut, borne singly or in pairs, rounded, covered with thick four-valved husk which splits open at maturity exposing white, thin-shelled oblong, ridged nut, containing a light brown, sweet, edible kernel. Nuts are of com-

mercial importance. Fruit ripe September or October.

Bark—Shaggy, light gray, separating into thick, vertical strips which remain attached to the tree, giving shaggy appearance and name. Bark on young twigs brownish, downy.

Shagbark Hickory
Leaf and fruit, one-third; twig, one-half natural size

Wood and Uses—Heavy, hard, tough, very strong, elastic, close-grained, light brown in color with whitish sapwood. Used in manufacture of agricultural implements, sporting goods, wagon spokes, carriages, auto wheels, baskets, tubs, etc. Very fine for fuel wood, much used in smoking meats. In its range makes fine ornamental tree.

Range—General distribution; southeastern Canada, Maine, St. Lawrence Valley, Great Lakes, southeastern Minnesota, south to western Florida and Texas. Distribution in Minnesota is confined to southeastern corner of state, extending northward into Wabasha County and west to Freeborn County. Prefers deep, moist soil.

## BITTERNUT HICKORY

(*Hicoria cordiformis* Britton)
(*Carya cordiformis* K. Koch)

HABIT—Tall, slender tree of graceful habit, growing to height of 40 to 75 feet and diameter of 10 to 24 inches on good sites, but usually smaller. Straight, clean trunk. Crown, round-topped, broad near top consisting of slender stiff branches. Faster grower than other hickories.

LEAVES—Alternate, odd number, compound, 6 to 10 inches long, composed of 5 to 9 leaflets, smaller than those

BITTERNUT HICKORY
Leaf, one-third; twig and fruit, one-half natural size

of other hickories. Leaves often unequal at base, long, taper-pointed, thin, firm; bright green above, paler, hairy underneath. Petiole of leaf hairy. Foliage fragrant when crushed.

FRUIT—Nut, enclosed in thin, hairy rounded husk, greenish-yellow in color, covered with small scurf-like scales. Husk usually splits part way down the side when seed is mature in fall. Nut thin, smooth; shell reddish-brown in color, with very bitter kernel, not edible. Nut broader towards its top.

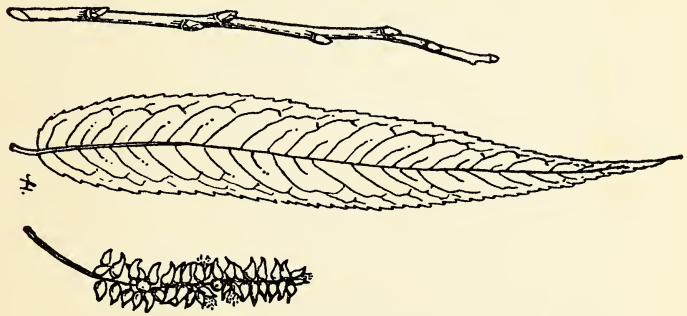
Bark—Granite-gray in color, faintly tinged with yellow, smooth on trunk, with shallow fissures. Bark does not strip off like that of the Shagbark Hickory.

Wood and Uses—Heavy, hard, strong, tough, close-grained, elastic; reddish-brown in color with thick, lighter-colored sapwood. A valuable wood, commercially used for about same purposes as Shagbark Hickory.

Range—New England to Minnesota, south to Florida and Texas. In Minnesota found in rich bottom lands or somewhat wet sites through "big woods" area north to Mille Lacs County. Occasionally found growing on hilly situations.

## WILLOW
(*Salix* species)

Habit—The willows consist of a large family of trees and shrubs. Some of the varieties are not commonly distinguished from each other. Many species are found scattered throughout the state and throughout the northern hemisphere. Those growing along streams and moist



Black Willow
Twig, leaf, and fruit two-thirds natural size

places reach large tree size while those inhabiting drier, less favorable sites are scraggly, dwarfed shrubs. Of the more common trees found in this region, the black and peach-leaved willow are particularly native, while the white and crack willows were originally foreign or *exotic*. The tree forms often grow to large size—35 to 50 feet high with diameters of 6 to 24 inches on favorable sites. Trunk usually short; stout spreading branches form a broad, rather irregular open crown.

## Willow Aspen

Leaves—White willow and crack willow leaves are whitish on lower surface. Crack willow easily recognized by twigs that crack or break from branches very easily, also by large saw-toothed leaves. Those of white willows are smaller, finely-toothed, and often permanently silky. White willow common, but crack willow exceeds it in abundance and distribution. The black willow is more native to southeastern counties and has very narrow leaves, green on both sides. The peach-leaved willow has long pointed, lance-shaped leaves, whitish underneath, borne on long, slender, somewhat twisted leaf stems or petioles. Whole tree somewhat greenish-yellow color, twigs somewhat drooping.

Fruit—Flowers in dense, elongated clusters known as "catkins"; flowers usually appear with the leaves in spring. The willows may be propagated with "cuttings" more easily than by seed. Seeds minute, maturing in late spring or early summer.

Bark—Dark brown to gray on large trees; thick, rough, furrowed and flaky.

Wood and Uses—Light brown, soft, weak, flexible, coarse-grained. Thin, whitish sapwood. Used for fuel, erosion planting, windbreaks, and ornamental planting. Many varieties are used for ornamental planting. Willow wood is used for baseball bats and charcoal, and large, good trees with straight grain are used in the manufacture of artificial limbs.

Range—A score of varieties occur over wide range in Minnesota and the United States from moist situations to dry upland prairies. Many European and ornamental varieties have been introduced.

## ASPEN (Popple, Quaking Aspen)
## (*Populus tremuloides* Michx.)

Habit—Tree small to medium size, reaching maximum height of 65 feet and diameter of 12 to 20 inches, but generally much smaller. Crown narrow, round-topped, fairly open and irregular. Branches slender and growing upward, drooping at tip. Trunk large with very little taper. Propagates by root suckers and seed. Will do well on sandy, gravelly soils but does best on good, loose soil. A short-lived tree.

Leaves—Alternate along the stem, small, broadly oval, short-pointed at the end, finely toothed along the

outer margin; at maturity thin, shiny green above, dull green below, ranging in size from 1 to 2 inches. Leaf stalks are flattened at right angles to leaves, causing leaves to rustle or quake in slightest breeze. Fall coloring golden yellow.

Fruit — Light brown, minute seed, contained in pale green, thin-walled capsule. Ripens in early spring (May or June) before full expansion of leaves. Propagated best by transplanting seedlings found growing everywhere, or by seed.

Bark—Twigs slender, smooth, greenish-white, thin. Bark on older growth gray-green with black areas around base of limbs. At base of old trees bark is nearly black, thick, roughened by deep fissures and flat ridges. Inner bark bitter.

Quaking Aspen
Trembling Aspen
Small-Tooth Aspen
Three-fourths natural size

Wood and Uses—Light, soft, weak; light brown, surrounded by nearly white sapwood. Decays readily in contact with soil. Used with spruce and balsam in manufacture of pulp. Occasionally sawed into lumber and boards for food containers such as lard pails, butter tubs, fish boxes; also used in turnery; valuable as a cover tree for quick growth while more valuable trees are coming on. Important in game management.

Range—Widely distributed in the United States and Canada in the lake states region and in all sections of Minnesota. One of the first species to appear after a cutting or fire. Will grow on sandy, gravelly soil but best growth is made on fertile soil, along border of lowland or in open forest glades. Seed carried long distances by wind.

## LARGE-TOOTH ASPEN (Poplar)
(*Populus grandidentata* Michx.)

HABIT—A tree of medium size but under very favorable conditions grows rapidly, sometimes reaching a height growth of 60 to 80 feet and a diameter of 10 to 20 inches, but usually smaller. Crown narrow but round-topped, open, with slender, rigid branches and fairly stout twigs. Resembles quaking aspen and found growing together with it.

LEAVES — Buds light gray, downy and fairly large. Larger, coarser-toothed than aspen leaves; more rounded in outline, tip rather blunt, densely covered with silky-like wool when young. Leaves borne on long, slender, flattened, not angled stalk. Leaves open later than the aspen. Mature leaves dark green on upper surface, paler below; smooth on both sides.

LARGE-TOOTH ASPEN
Leaf, twig, and fruit, one-half natural size

FRUIT — A capsule like that of the aspen, containing seeds which mature in May and are set free as leaves unfold. Propagated by seed or cuttings.

BARK—Smooth, thin, bronze-green or gray on upper part of tree trunk. At base of old trunk, dark brown or blackish, roughened by fissures and broad flat ridges.

WOOD AND USES—Light, weak, soft, close-grained, light brown in color with thin, nearly white sapwood. Used for excelsior, pulp, small extent woodenware and turnery, and straight poles for particular uses. Important from forest standpoint because of fast growth in establishing a forest cover. Useful in game management.

RANGE—Grows on sandy or rich soils, especially along borders of streams, ponds or lakes. Found generally from Nova Scotia west to northern Minnesota, south to North Carolina, Kentucky and Tennessee.

## COTTONWOOD
(*Populus deltoides* Marsh.)

HABIT—A fairly large tree, attaining height of 50 to 80 feet, and diameter of 2 to 4 feet. Crown long, broad, open, pyramidal, with coarse-spreading, slightly drooping branches.

LEAVES—Broad, heart-shaped, long-pointed edges, finely toothed, borne on long, slender stems, which are compressed laterally. Teeth along outer margins of leaf uncurved. Color, dark green, shiny above, paler underneath and covered with soft white hairs when leaves are young. Winter buds are covered with chestnut brown, resinous scales.

COTTONWOOD
Leaf and fruit, one-half; twig, one-third natural size

FRUIT—A 2 to 4-valved thin capsule borne on a short stalk in drooping catkins. Seed when set free in late May or June minute, pale, brownish-white, densely cottony. Two kinds of flowers borne separately on different trees. Female tree throws "cotton." Tree easily propagated by "cuttings" or seedlings found along watercourses.

BARK—Light gray-green on young trees; old trunks ashy gray, thick with narrow fissures and broad scaly ridges.

WOOD AND USES—Soft, light, spongy, weak but close-grained. Color, dark brown with thick whitish sapwood. Wood warps badly if not properly dried. Will not last long in contact with soil. Used for rough lumber, box material, excelsior, fuel. Has been used to make high grade gloss magazine paper for printing of half-tone

illustrations. Tree used in windbreak planting and erosion control on account of fast growth. Too often used for city plantings.

RANGE—Widely scattered through northern region to Rocky Mountains, south to Florida and New Mexico. Found throughout Minnesota, often forming extensive groves. Will grow in dry situations but makes most rapid growth in moist sites.

## BALM OF GILEAD (Balsam Poplar)
## (*Populus balsamifera* L.)

HABIT—Attains large size on favorable sites, sometimes to height of 50 to 80 feet with a trunk diameter of 1½ to 3 feet or more. An upright growing tree with a rather broad crown, irregular and fairly open. Stout, spreading, fairly stout branches, bushy at ends. A short-lived tree.

BALM OF GILEAD
Twig, one-third; leaf and fruit, one-half natural size

LEAVES—Alternate, borne on long, slender, hairy stems. Leaves dark green and shiny above, finely toothed; pale brownish-white with bronze color effect as you look up into the crown from below. Buds long, pointed, covered with varnish-like resin; strong, pungent odor, resembling balsam.

FRUIT—Appears in May or June; pale brown capsule curved at tip, opens late May or early June, setting free minute pale brown seeds covered with cotton-like hairs. Propagates easily by root suckers.

BARK—Smooth on mature portion of the tree, dark

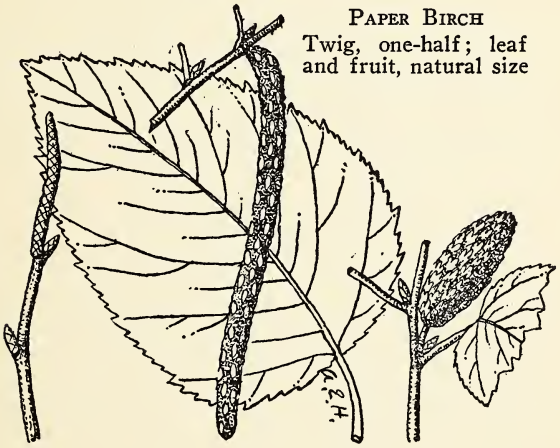
gray in color, thick, with narrow fissures, and broad, scaly ridges.

Wood and Uses—Heavy in weight when green, light when dry. Light brown in color; sapwood lighter. Weak, soft, close-grained. Of not much commercial value. Used for packing cases, boxes, pails, and rough lumber.

Range—Found throughout northern Minnesota and through northeastern and central states and eastern Canada. Prefers moist situations along streams, edges of swamps, and other cool, moist sites.

## PAPER BIRCH (Canoe Birch, White Birch)
## (*Betula papyrifera* Marsh.)

Habit—Grows to good size, often found 60 to 70 feet high with a trunk diameter of 14 to 20 inches but usually smaller. In mature crowded forest, trunk clean, support-



Paper Birch
Twig, one-half; leaf and fruit, natural size

ing a rather narrow, open, round-topped head. Young trees in open often have branches nearly to ground. Trees have watery juice.

Leaves—Heart-shaped, alternate, pointed or rounded at tip end. Coarse, double-toothed; texture leathery and firm. Color dark green above, yellowish-green on underside, somewhat hairy. Leaves carried on stout, yellowish-colored stalks.

Fruit—Resembles a cone containing many minute seeds; pale brown in color, suspended and hanging down-

ward on short stalk. Seed ripe in autumn and propagates readily if sown at that time or stratified over winter and sown in spring.

Bark—Twigs and young growth dull orange or reddish during the first winter; at later age becomes dark brown. Mature trunk covered with thin, papery bark, chalky white in color, peeling off in thin, papery layers which often roll up. Base of older trees brownish-black, irregularly furrowed.

Wood and Uses—Hard, strong, tough, close-grained, light brown tinged with red; sapwood nearly white. In great demand by wood-using industries for spools, shoepegs, lasts, toothpicks, turnery, toys, woodenware, snowshoe frames, handles, interior finish, lumber, flooring, cabinet making, fuel wood, paper pulp, veneers and ties. Bark is often used in making containers, novelties of many kinds, and canoes. The tree is also used in ornamental plantings. Birch is often tapped to make syrup and sugar. Bark and leaves used for medicinal purposes.

Range—Prefers a moist site but does fairly well on drier situations. Found generally through north central states and Canada. Follows pretty well coniferous and hardwood forest range, moist hillsides, and watercourses.

## YELLOW BIRCH
(*Betula lutea* Michx.)

Habit—On good sites a tree of large proportions, reaching a height of 85 feet and a diameter of 2 to 3 feet or more. In open, wide spreading crown, often with short or crooked trunk.

Leaves—Alternate, oval, slightly oblong, heart-shaped and equilateral at base. Along outer margins doubly and finely-toothed. Dark green above, paler yellowish-green below, with veins hairy. Leaves borne on slender, pale yellow, hairy stems. Leaves larger than those of paper birch.

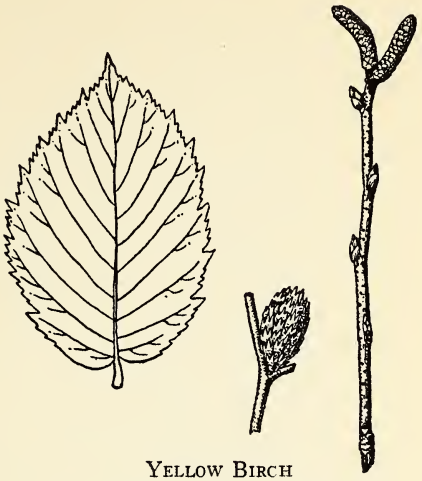
Fruit—Small, woody, erect, oblong cone in which is contained winged seed, chestnut-brown in color when ripe.

Bark—Yellow-gray or straw-colored, separating into thin papery layers, which coil and hang loosely on tree. Young bark thin, shiny, silvery, and gray in color; at base of old tree bark reddish-brown, deeply furrowed.

Wood and Uses—Heavy, strong, hard, close-grained, reddish-brown in color with nearly white sapwood. Wood

takes good polish. Used in flooring, interior finish, veneers, turnery, novelties. Often used in high grade furniture. Fine fuel wood. From this tree is also made commercial oil of wintergreen. A commercially important valuable hardwood.

RANGE — Requires cool, moist site; found in company with sugar maple, ash, spruce, pine and fir. Found in Newfoundland through northern states region, south to North Carolina and Tennessee. In Minnesota, northern half of state in rich, moist uplands.



YELLOW BIRCH
Leaf and twig, one-half; fruit, one-fourth natural size

## RIVER BIRCH (Red Birch)
(*Betula nigra* L.)

HABIT—Normally a large tree, comparing favorably to yellow birch, but in Minnesota a tree of medium size. Trunk short, usually dividing near the base into several ascending limbs, forming an irregular, open, round-topped crown; on poorer sites a bushy tree branching nearly to ground.

LEAVES—Alternate, irregularly double-toothed edges, somewhat lobed, thin but firm in texture, triangular in shape. Upper surface dark green, underside pale yellowish-green and slightly hairy.

FRUIT—Woody, erect, pale brown cone, oval in shape, about one inch long. Ripens in late summer. Seed, chestnut-brown, with hairy wings, narrower than nutlet.

BARK—Varies reddish-brown to cinnamon-red in color which peels back in tough, papery layers, giving tree ragged appearance. These loose layers persist on all branches as well as trunk. Unlike other birches, paper layers

usually covered with gray powder. On old trunks, bark becomes thick, deeply furrowed and of reddish-brown color.

Wood and Uses—Strong, fairly close-grained, light, medium hard, light brown in color with pale sapwood. It has been used for manufacture of woodenware, wagon hubs, cheap furniture, in turnery, and for fuel.

River Birch
Two-thirds natural size

Range—Moisture-loving specie, found along banks of streams, ponds, and lakes, rarely on dry sites. In Minnesota chiefly along Mississippi and Root River valleys in southeastern corner. Central New England to Minnesota, south to Florida, Texas.

## IRONWOOD (Hop Hornbeam)

(*Ostrya virginiana* K. Koch.)

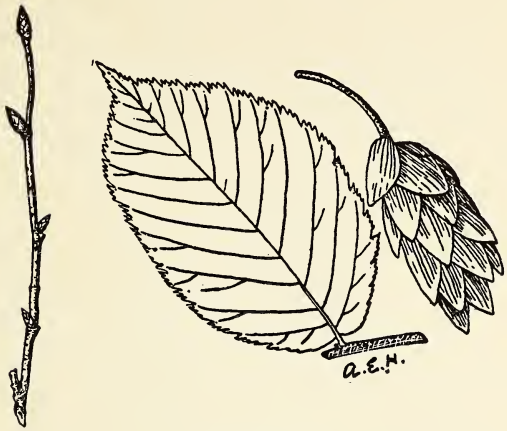
Habit—Small, slender, broad, round-topped tree from 20 to 35 feet high and 5 to 12 inches in diameter. Crown consists of long, slender, wire-like branches, drooping toward ends. Trunk short.

Leaves—Alternate, borne on short, slender stems. Leaves oblong, thin, tough, with taper-pointed tip; sharply and finely toothed along margins. Color yellowish-green above, pale green underneath, with tufts of pale hairs along some of veins and stems. The Ironwood is frequently confused with American elm, but has different characteristics.

Fruit—Resembles that of hop vine (hence its name); consists of a cluster of membranous sac-like bracts, one half to three-quarters of an inch long, each containing one flattened, ribbed, hard nutlet. Fruit borne on slender, hairy stems. Ripe in September.

BARK—Light gray-brown or grayish, finely divided, thin, consisting of narrow, oblong, thick scales, easily rubbed off. Bark often grows twisted around tree.

WOOD AND USES—Light brown, with thick, pale sapwood. Very strong, heavy, close-grained; not durable in



IRONWOOD
Twig, leaf, and fruit, one-half natural size

contact with ground. Used for tool handles, levers, wedges, mallets, fence posts; good fuel wood.

RANGE—Usually found in rich, cool situations, gravelly slopes and ridges. Has wide range in northern and central states, south to northern Florida and eastern Texas. Found throughout Minnesota except in vicinity of Lake of the Woods.

## BLUE BEECH (American Hornbeam)
## (*Carpinus Caroliniana* Walt.)

HABIT—A slow-growing shrub or low, bushy tree, with spreading top of slender, crooked, or drooping branches. Short, usually fluted trunk. Often forms thickets, but usually scattered singly.

LEAVES—Alternate; about one-half as broad as long, rounded at base; thin, firm, dark green above, paler green and shiny below with indications of pale hairs at axis of veins. Veins prominent, resembling those of ironwood. Outer margins double-toothed.

Fruit—In clusters at end of new growth with leaf-like bracts, three-lobed, enclosing a small nut, ripening late in autumn. Leaf-like bract acts as a wing in distribution. Propagation by seed.

Blue Beech
One-half natural size

Bark — Dark, bluish-gray, usually mottled with lighter or darker patches. Bark smooth, hard, close-fitting, often fluted.

Wood and Uses—Heavy, strong, close-grained, hard, fairly durable. Light brown in color with thick, very white sapwood. Used occasionally for tool handles, levers, wooden cogs, mallets, wedges. Of little commercial value.

Range—Found on low ground and in moist situations along streams and around lakes in northern states region from Nova Scotia to Ontario, south to Florida, scattered through southern half of Minnesota as far north as Itasca Park and White Earth Indian Reservation.

## WHITE OAK
(*Quercus Alba* L.)

Habit—A large tree reaching height of from 60 to 100 feet and a diameter of 2 to 4 feet when growing on good sites. In dense forest has long, straight, clean trunk with a narrow crown; in open, trunk short, head consisting of massive, gnarled, wide-spreading limbs to form an open, broad, irregular crown.

Leaves—Alternate, wide, about half as broad as long; cut-in or lobed halfway to midrib in 5 to 9 rounded, finger-like lobes; crowded toward ends of twigs. Young leaves when unfolding, soft, silver-gray, yellow, or red, becoming bright green above, paler below; stems short, flattened. In fall leaves turn purplish red and often remain on trees all winter.

Fruit—An acorn; nut rounded, oblong, chestnut-brown in color, shiny at maturity and enclosed to one-

fourth to one-third its length in a warty cup. Kernel edible, sweet. Nut ripens fall of first season and germinates in a few weeks after it is ripe in coming in contact with ground, sending down long taproot before winter.

White Oak
Leaf and fruit, one-third; twig one-half natural size

Bark—Ash-gray in color, covered by loose scales or plates. On old trunk, bark thick, divided by shallow fissures. Bark astringent, used in tanning.

Wood and Uses—Heavy, strong, hard, tough, close-grained, durable. One of the most valuable woods, used for heavy construction, interior finish, furniture, farm implements, ties, etc. Light brown in color with lighter sapwood. Tree also used in ornamental plantings.

Range—Found over wide area in northern, central states, and south to Florida and Texas. In Minnesota found mostly in southeast part of the state and scattered individually or in mixtures with other hardwoods. Found growing best in moist situations.

## BURR OAK (Mossy Cup Oak)

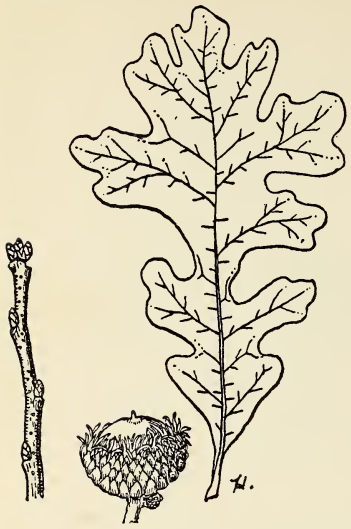
(*Quercus macrocarpa* Michx.)

Habit—One of our most common trees, sometimes a large tree on good sites, but on sandy sites gnarled, short, scrubby. Occurs in company with other trees, in small groups, or singly. Grows slowly. Crown open and round-topped with heavy, massive, short, spreading branches. Short trunk.

Leaves—Alternate, variable in shape, resembling those of white oak; irregularly lobed, deeply lobed at middle portion; green above, paler below; crowded at ends of branches. Stem short, flattened. Leaves often persist on tree until late in winter.

## Burr Oak, Swamp White Oak

Fruit—An acorn, set deeply in fringed, burr-like cup, ovoid in shape. Ripe in autumn of first season. Kernel bitter; nut, chestnut-brown, slightly hairy at apex, half enclosed in outside cup.



Burr Oak
One-third natural size

Bark—Light gray in color, darker than that of white oak, usually divided by deep furrows into irregular small narrow plates.

Wood and Uses—Heavy, close-grained, hard, strong, tough durable. Rich brown in color, paler sapwood. Used for furniture, cooperage, interior finish, ties, fuel.

Range—Eastern Canada west to Manitoba, central prairie states. In Minnesota very common, extending even far out in the prairies in western part of the state. Not found in northeastern part of the state. Prefers rich, moist soils but will tolerate many poorer soils.

### SWAMP WHITE OAK
(*Quercus bicolor* Willd., formerly *Q. Plantanoides* Sudw.)

Habit—Often grows to a height of 65 feet with a trunk 2 to 3 feet in diameter, but usually much smaller in size. Found in the open, the tree has broad open crown with rather drooping branches. In crowded stands trunk clear for some distance.

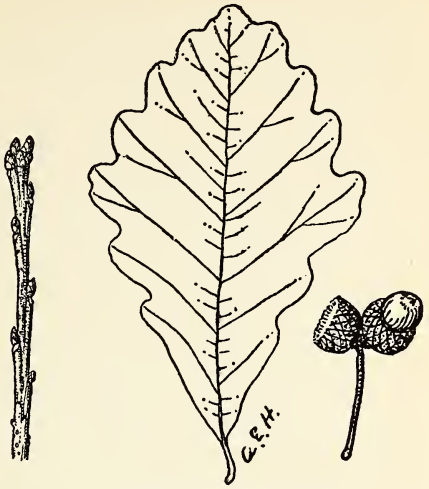
Leaves—Alternate, pear-shaped, rounded at apex; at maturity thick, firm, shiny green above, white, hairy below; borne on short stalks. Leaves wavy and indented along margins.

Fruit—Acorn, frequently occurring in pairs, requiring only one season to mature. Fruit borne on slender stalk; nut oval, chestnut-brown, round, pointed and hairy-like at apex; enclosed about one-third its length by a thick, woody, pale-brown cup. Ripe in autumn.

BARK—Deeply and irregularly divided by fissures into broad ridges, scaly at the surface. Mature bark grayish-brown; bark on twigs or young growth is ragged, often peeling.

WOOD AND USES—Heavy, hard, strong, close-grained, durable. Pale brown with lighter sapwood. Uses similar to those of white oak.

RANGE—Eastern United States west to Minnesota, eastern Iowa south to Georgia and Arkansas. Found, as name implies, growing on moist soil such as river bottoms. In Minnesota confined almost entirely to southeastern section, associated with other hard woods.



SWAMP WHITE OAK
One-half natural size

## RED OAK

(*Quercus borealis* Michx., formerly *Q. rubra* L.)

HABIT—One of our large oaks, attaining height of 50 to 80 feet and diameter of 2 to 3 feet, and in some instances larger. Under forest conditions tree is tall, straight, with clear trunk and narrow crown. In the open, trunk is short, massive, with stout limbs forming broad symmetrical crown. Most rapid grower of the oaks.

LEAVES—Alternate, somewhat oblong, lobed halfway to midrib; 7 to 11 lobes each with bristle-pointed tip. At maturity leaves thin, shiny, dull dark green above, paler below. Leaves turn dark red in fall.

FRUIT—Large acorn, round, oblong; nut, three-fourths to nearly two inches long, usually borne singly or in pairs; chestnut-brown in color, often striped. Nut half enclosed in saucer-shaped cup; thick, brownish, hairy inside. Matures autumn second year. Kernel, bitter.

BARK—Smoother than that of most oaks; shiny light brown on young growth; dark brown on old trunks, divided into irregular ridges and plates, scaly at surface. Inner bark light red, rich in tannic acid.

WOOD AND USES—Hard, strong, coarse-grained. Pale reddish-brown in color with paler sapwood. Used for

RED OAK
Twig and fruit, one-half; leaf, one-third natural size

construction, furniture, interior finish, ties, but less durable than white oak. Also used for cooperage, fuel, etc.

RANGE—Prefers well-drained sites such as gravelly or sandy loams, but will grow on other sites. Found in eastern states to Minnesota, south to Florida and Texas. In Minnesota quite general throughout forest region along Mississippi River. More abundant in rich soil of central portion of state.

## SCARLET OAK (Jack Oak, Pea Oak)
## (*Quercus ellipsoidalis* Hill)

HABIT—Generally a medium-sized tree but may reach height of 40 to 65 feet with diameter of 2 to 3 feet on good sites. Growing in open, crown narrow, irregular, rounded, with wide spreading, drooping lower branches. Growing in dense stands, crown narrower. The trunk tapers quickly.

## Scarlet Oak

Leaves—Alternate, somewhat oblong, slender, with 7 to 9 lobes, divided at tip end, and bristle-pointed. Lobes cut in over halfway to midrib. At maturity, leaves thin, shiny, dark green above, paler below. Leaves turn brilliant red or scarlet in autumn, remain on trees all winter, and fall in spring.

Fruit — Acorn, borne singly or in pairs; reddish-brown in color, often striped; about half enclosed by the cup. Cup reddish-brown, with slightly hairy scales on outside. Nut ripens second season. Kernel bitter.

Scarlet Oak
Twig and fruit, one-half; leaf, one-third natural size

Bark—Young bark light reddish-brown, smooth; mature bark dark brown, thin, divided into irregular ridges and plates; not so flat-topped as red oak; scaly at the surface. Inner bark light yellow.

Wood and Uses—Heavy, hard, strong, coarse-grained; inferior to that of red oak. Used in manufacture of furniture, interior finish, fuel. Reddish-brown in color, sapwood lighter. Tree often used for ornamental planting because of fall coloring.

Range—South portion of Atlantic states to southern Minnesota and eastern Nebraska and south to North Carolina. Prefers light sandy or gravelly soils. In Minnesota found in southeastern section and as far north as Cass Lake, except on limestone soils. Found associated with other oaks.

## BLACK OAK

(*Quercus velutina* Lam.)

HABIT—A medium-sized tree 35 to 75 feet in height and 9 to 30 inches in diameter. Crown irregularly shaped, wide spreading in open, with slender branches.

LEAVES—Alternate, thick, varying in shape; deeply divided into 5 to 7 bristle-pointed lobes. Crimson in color when first coming out, turning silvery and woolly when

BLACK OAK

Twig and fruit, one-half; leaf, one-third natural size

half grown; when mature dark green, glossy above, paler, more yellowish below; brown in fall.

FRUIT—Acorn, nut light brown, rounded, covered with whitish down, about half enclosed by thin, broad, top-shaped cup, reddish-brown in color, with thin scales. Nut borne singly or in pairs, ripens second season. Kernel yellow, bitter.

BARK—On young trees smooth and dark brown. Mature bark dark brown, nearly black; thick, rough, deeply furrowed with broad rounded ridges, scaly at surface. Inner bark orange-colored, bitter, containing much tannic acid.

WOOD AND USES—Heavy, hard, strong, coarse-grained, not tough; light reddish-brown in color with thin outer edge of paler sapwood.

## Black Oak, American Elm

Of little commercial value except for fuel. May sometimes be mixed with other oak for commercial use. Bark used for tannin and as yellow dye.

Range—Southern Maine to Minnesota, Nebraska to Mississippi and Florida. In Minnesota found almost entirely in southeastern part, on dry hills. Prefers well drained sites or ridges, glacial drift, gravelly uplands. Does well on poor soils.

## AMERICAN ELM (White Elm)
*(Ulmus americana* L.*)*

Habit—One of our largest trees, often reaching 80 to 90 feet in height and 2 to over 4 feet in diameter. Trunk fairly clear but divides into many branches to form a graceful umbrella form of crown when growing in the open. In close forest stands trunk fairly straight with smaller, rounded head.

Leaves—Alternate, rather thick, unbalanced, rough above, doubly toothed on outer margin; veins very prominent and run parallel from midrib to edge of leaf. Dark green above, paler below.

American or White Elm
One-half natural size

Fruit—Wafer-like, winged; seed portion in center surrounded entirely by wing. Seed and wing about size of oatmeal flake, pale green in color. Seed flake has a deep notch in the outer end of wing distinguishing it from other elm species. Seeds hang in clusters, ripen in spring, and are widely disseminated by the wind.

Bark—Dark gray in color, divided into irregular flat-topped, thick ridges, usually firm, but on older trees tending to come off in flakes. If bark is cut into, it will show alternate layers of brown and white bark layers.

Wood and Uses—Hard, heavy, strong, tough, difficult to split. Light brown in color with paler sapwood. Used for wheel hubs, saddle trees, boats, furniture, staves, hoops, and veneer for baskets and crates. Has wide use

for ornamental, windbreak, and prairie planting because of hardiness and fairly rapid growth.

Range—Common throughout most of the states to eastern slopes of Rockies. Prefers rich bottom lands but will grow on drier sites. Found quite generally in Minnesota.

## ROCK ELM (Cork Elm)
*(Ulmus racemosa* Thomas.*)*

Habit—About same size as American Elm. Trunk grows straight and clear; small branches often have corky

Rock Elm
Fruit, two-thirds; leaf and twig, natural size

ridges along the edges. In the open, narrow, oblong, round-topped. Trunk straight and continuous into crown.

Leaves—Alternate, resembling those of American Elm, but smaller and not so unbalanced; smoother on both sides, leathery; midrib and veins prominent. Color dark green and shiny above, paler, hairy below.

Fruit—Wafer-like, one-seeded. Same type of seed as that of American Elm but notch at outer edge of wing not as deeply cut.

## Rock Elm, Slippery Elm

Bark—Dark gray, resembling that of American Elm, but a little thicker and divided into broad, flat ridges with shallow grooves, scaly at surface; young twigs slender, light-reddish brown, shiny, often corky-ridged.

Wood and Uses—Best of the elms. Close-grained, compact, strong, splits hard but fairly straight. Used for agricultural implements, hubs, sills of buildings, ties, wheel rims, sporting goods, furniture, staves and hoops. Also used for some ornamental planting. Light reddish-brown in color with thick, lighter sapwood.

Range—Quebec, Ontario, Vermont, northern New York west to Minnesota, south to Tennessee and Missouri. In Minnesota found in eastern and south central portions of the state in the Minnesota Valley north to Clearwater County. Prefers rich, well-drained, moist soil but does well on dry uplands, especially limestone outcrops and heavy clay soils.

## SLIPPERY ELM (Red Elm)
(*Ulmus fulva* Michx.)

Habit—A large tree, on good situations attaining a height of 40 to 65 feet and diameter of 16 to 24 inches. Trees usually of medium size, although larger trees are often found. Trunk usually short, breaking up into many large spreading limbs forming broad, open, flat-topped head.

Slippery Elm
Twig and fruit, one-half; leaf, one-third natural size

Leaves—Alternate on the stem, ovate, sharp-pointed, coarsely doubly-toothed; base of leaves unsymmetrical, thick, rough on both sides. Dark green in color, pale, whitish, hairy below. Leaves turn dull yellowish-green in fall and are fragrant when drying.

Fruit — Wafer-like seed surrounded by thin, broad, greenish wing. Ripens in spring when leaves are about half-grown. Seed nearly circular; unlike other elms, seed does not grow same season it matures.

BARK—Dark gray or brownish in color; thick, broken by shallow fissures into flat ridges. Inner bark pale white, fragrant; when chewed, affords a slippery, mucilaginous substance from which tree gets its name. Used to some extent for medicinal purposes.

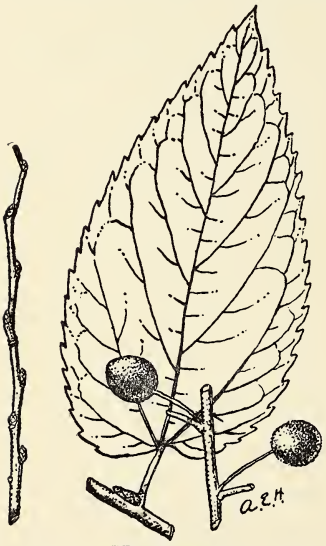
WOOD AND USES—Close-grained, tough, strong, heavy, hard, moderately durable in contact with soil. Used for posts, cross-ties, agricultural implements, ribs for small boats, athletic goods, fuel, etc. Wood dark brown in color with lighter sapwood. Fairly fast grower; used to some extent for ornamental planting.

RANGE—Southern Canada to North Dakota, south to Florida and Texas. Common in Minnesota, found principally along banks of streams and on lowlands in rich moist soil.

## HACKBERRY

(*Celtis occidentalis* L.)

HABIT—A fairly large tree, 40 to 75 feet high and 10 inches to 3 feet in diameter when found on good soil. Limbs often crooked and angular. Crown made up of slender, pendant branches, or short, bristly, stubby twigs. In open, crown symmetrical, forming round-topped head like hard maple.



HACKBERRY
Leaf, one-third; twig, one-half natural size

LEAVES — Alternate on twig, ovate, edges coarsely toothed except at ends; prominent veins and hairy on upper surface. Light green above with sunken veins; pale below, somewhat hairy on prominent veins. In autumn leaves turn light yellow.

FRUIT—A round, somewhat oblong berry, with thin, purplish skin, yellowish, sweet flesh. Because of this characteristic often called sugarberry. Ripens in September and may hang on tree most of winter. When mature, fruit dark purple.

BARK—Grayish, rough, with scale-like or warty projections of dead bark. Bark on some young trees smooth enough to resemble beech.

WOOD AND USES—Heavy, rather soft, weak, coarse-grained, but fairly durable in contact with soil. Yellowish or greenish-brown in color with narrow white sapwood. This tree is often used in ornamental planting. Wood used in manufacture of cheap furniture, boxes, fencing; used a great deal for fuel.

RANGE—Quebec, Ontario west to Lake of the Woods and Dakotas, eastern Washington and Oregon, south to Florida, eastern Texas. Found sparingly in southern part of Minnesota and north through Red River Valley; scattered by birds. Most abundant and reaches largest size on rich alluvial lands but will thrive on many other soils from poorest to richest. It seems also to do very well on limestone soils.

## MOUNTAIN ASH

(*Sorbus americana* Marsh.)

MOUNTAIN ASH

Leaves and fruit, one-third; twig, three-fourths natural size

HABIT—A small tree 20 to 30 feet high and 4 to 12 inches in diameter. Often a shrub. Trunk short, breaking

up close to ground into spreading branches forming narrow, round-topped head.

Leaves—Compound, composed of 13 to 17 leaflets 3 to 4 inches long; leaflets taper-pointed with toothed edges; bright green above, lighter below, turning bright yellow in autumn.

Fruit—Bright orange berry, rounded, with thin flesh, having sour taste. Fruit ripens in autumn and remains on tree after leaves have fallen, sometimes all winter, giving ornamental effect. Astringent properties of fruit make it useful for medicine.

Bark—Mature bark thin, light gray to brown, smooth on trunk with horizontal markings on branches.

Wood and Uses—Light, soft, weak, pale brown in color with light-colored sapwood. Slow growth of tree gives a very close grain. Of no commercial importance but has good ornamental value because of fall fruit. Inner bark has some medicinal qualities.

Range—Newfoundland to Manitoba and southward through northeastern United States and lake states. In Minnesota found scattered in woods of northern portion of state as far south as Pine and Mille Lacs Counties, generally along edges of lowland areas.

## JUNEBERRY OR SERVICEBERRY
(Shadbush)
(*Amelanchier laevis* Wieg.)

Juneberry
Serviceberry
Shadbush
One-half natural size

Habit—A small tree, up to 30 feet high with trunk diameter of 4 to 10 inches. Rather narrow, rounded crown; trunk straight, slender, with very little taper. On some situations this tree is little more than a shrub. Twigs slender, shiny, somewhat zigzag. Crown a fine network of branches.

Leaves — Alternate, ovate, oblong, finely toothed; at maturity thick, firm and shiny; purplish-brown until nearly mature, then light to dark green above, paler below with hairy veins.

FRUIT—Sweet, edible berry, rounded; at first bright red, dark purple when ripe; ripe in July or August. Has white flowers appearing in drooping clusters in April and May, when leaves one-third grown, making the tree quite conspicuous in the leafless or budding forest.

BARK—Young bark smooth, reddish-brown, with small, minute, light streaks. Mature bark thin, ashy-gray to brown; divided by shallow fissures in narrow, scaly, long ridges.

WOOD AND USES—Not a timber tree; wood heavy, very hard, strong, close-grained; dark brown in color, often tinged with red, with thick, paler sapwood. Occasionally used for tool handles and fishing rods. Desirable for ornamental planting. Wild fruit a favorite food for birds; often harvested for jellies and jams.

RANGE—Great Lakes states, central states south to Georgia and Louisiana. Found throughout Minnesota, scattered by birds. Makes best growth along banks of streams, lake shores and upland woods. Will grow in fairly dry situations. Fruit has been used for medicines.

## BLACK CHERRY (Wild Cherry)
(*Prunus serotina* Erh.)

HABIT—Largest of the cherries, on good sites reaching height of 70 feet and diameter of 8 inches to over 2 feet. Forest-grown trees have long clear trunks with only slight taper; open-grown trees have short trunk with many branches and irregularly spreading or oblong crown.

LEAVES—Alternate, lance-like or oblong in shape, pointed, with finely incurved teeth; thick, shiny, dark green above, paler below. Leaf stem usually bears 2 to 4 reddish glands near base.

FRUIT—A short-stalked, shiny, red berry, borne in drooping clusters, turning dark purple when ripe in fall. Skin thick; flesh thin, juicy, edible but bitter, with small stone. White flowers appear in clusters in May or June when leaves are nearly grown.

BARK—On young branches and trees, smooth, shiny, reddish, marked with many pale streaks. Older bark is thin, dark reddish-brown, becoming rough and broken into small, scaly plates. Bruised twigs have odor and taste of almonds.

WOOD AND USES—Moderately heavy, hard, strong, fine-grained, does not warp or split in seasoning; color

pale reddish-brown with yellowish sapwood. Wood has great commercial value; valuable for furniture, interior finish, tools, implement handles; takes good polish.

Wild Black Cherry
Twig, two-thirds; leaf, one-third; fruit, one-half natural size

Flowers and fruit of black cherry make it desirable for ornamental planting.

Range—Nova Scotia west through prairie provinces, eastern and north central states, south to Florida and Texas. Prefers rich bottom lands but will grow on fairly dry, gravelly or sandy soil.

## PIN CHERRY (Wild Red Cherry)
(*Prunus pennsylvanica* L.)

Habit—Usually a shrub or small tree not over 20 to 25 feet high with trunk diameter of 4 to 8 inches. Trunk short; crown narrow, with rounded top consisting of many slender branches.

Leaves—Alternate, lance-like, sharply pointed with finely incurving teeth along outer edges; at maturity bright green above, paler below, smooth on both sides.

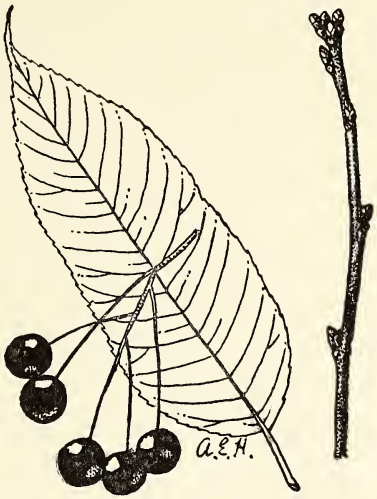
Fruit—A light red berry with thin skin, sour flesh, and stone ridged on one side, hanging in clusters, maturing in July or August. Creamy white flowers appear in May or early June when leaves are one-fourth grown.

Bark—On young growth shiny, bright red to grayish-

brown; mature bark thin, reddish-brown, smooth but with long, light markings; inner bark bright green. Broken twigs have bitter taste and odor.

WOOD AND USES—Not a timber tree. Wood hard, heavy, not very strong. Valuable chiefly as bird food, for ornamental planting and for jellies. Establishes itself rapidly. Hardy, used in shelter belt planting and for soil protection. Fruit used for home medicines.

RANGE—New York, Labrador to British Columbia, south to Pennsylvania, upper Missouri Valley, south to New Mexico and western Florida. In Minnesota fairly common along streams, open moist woods and cut-over, burned-over areas. Will grow on dry land.




PIN CHERRY
WILD RED CHERRY
Leaf and fruit, natural size; twig, one-half natural size

## CHOKECHERRY
(*Prunus virginiana* L.)

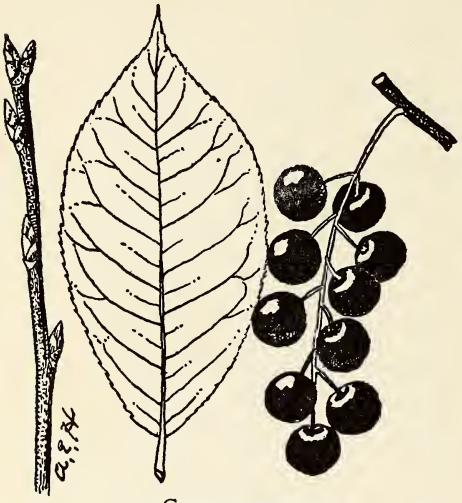
HABIT—A shrub or small tree not over 20 to 25 feet high and with a trunk diameter of 3 to 8 inches. Crooked branches and twigs form a rounded, narrow crown. Trunk usually inclined or crooked.

LEAVES—Alternate, ovate, thin, abruptly sharp-pointed, finely and sharply-toothed at maturity; bright green, shiny above; also shiny, paler below.

FRUIT—Short-stalked, bright red berry, borne in drooping, shiny clusters, ripening in July or first part of August. Skin of fruit thick; flesh thin with darkish color. Very astringent to taste except when dead ripe. Stone ridged on one side. White flowers appear in May when leaves are nearly grown.

BARK—Reddish-brown to dark brown on young growth, smooth except for lighter, rougher streaks; inner bark very bitter cherry flavor. Mature bark grayish brown in color, often roughened by shallow ridges.

WOOD AND USES—Hard, heavy, close-grained, not strong, light to dark brown in color, with lighter sapwood. Of no commercial value. Relished by birds who help scatter seed, especially along fence rows, often forming dense thickets.



CHOKECHERRY
One-third natural size

RANGE—Found on variety of soils, fence rows, stream and watercourses, in both Canada and United States. Widely distributed; Labrador west through Hudson's Bay to British Columbia, north almost to Arctic Circle, southward to Georgia, Texas, California. In Minnesota fairly common along stream courses, open woods, also in cut-over and brush areas. Is used often for planting in dry windbreak areas.

## WILD PLUM

(*Prunus americana* Marsh.)

HABIT—A thorny shrub or small tree 20 to 35 feet high with trunk diameter up to 12 inches. Trunk short, usually dividing 4 to 5 feet above the ground into many slender, spine-tipped, spreading branches, forming quite a broad, deep crown. Usually grows in dense thickets.

LEAVES—Alternate, long, oval, sharply and often doubly-toothed, thick, firm; dark green above, paler, slightly hairy below.

FRUIT—Shiny, rounded plum, green when immature, turning to orange red, often with heavy bloom when ripe;

ripening in late summer. Skin thick, tough; flesh sweet, bright yellow, adhering to stone; stone thick-walled, oval, inside seed oval, light brown.

White flowers, strongly scented, appear in April or May when leaves are about one-half unfolded.

Bark — Pale, reddish - brown, smooth; mature bark thin, breaking up into thin, persisting plates.

Wood and Uses — Strong, hard, close-grained, dark brown in color, thin lighter sapwood. Takes a good polish. Has no commercial value except for ornamental uses and its fruit, which is prized for preserves. Hardy on many kinds of soil. Used in planting prairie groves.

Wild Plum
Three-fourths natural size

Range—Prefers rich soil, found best along stream courses and moist situations, but will thrive on drier, poorer sites. Distributed by birds. New York west to Montana or upper Missouri Valley, south to Florida, eastern Texas. In Minnesota quite generally scattered through state, particularly along watercourses.

## HONEY LOCUST (Black Locust)
(*Gleditsia triacanthos* L.)

Habit—Medium-sized tree, 40 to 60 feet high, taller under good conditions. Trunk 10 to 20 inches in diameter, usually short, dividing 9 to 12 feet above the ground into several large, spreading branches and zigzag twigs, forming a broad, oval, flat-topped crown. Trunk marked with clumps of stout thorns.

Leaves—Alternate, 18 to 28 compound or twice compound leaflets, feather-like in appearance; leaves borne on flat, hairy stem, grooved above and enlarged at base. Mature leaves dark green, shiny above; dull yellowish-green below.

Fruit—A pod 10 to 18 inches long, thin, reddish to purplish brown, borne in clusters, ripe in autumn, twisted as it reaches maturity. Seed in pod oval, flattened, brown in color; very hard; seeds separated from each other by pulp partitions. Pods eaten by many animals and as seeds are hard to digest they are passed out, thus aiding distribution. Small, greenish flowers appear in June when leaves are full grown.

Honey Locust
Twig, three-fourths; leaf and seed pod, one-fourth natural size

Bark — Young twigs, smooth, shiny, reddish-brown to grayish-brown; straight, strong, brown thorns, branched, sharp, shiny, borne above leaf scars, persist for few years. Mature bark thick, grayish-brown, almost black, roughened and divided by deep fissures into long, narrow ridges; scaly at the surface.

Wood and Uses—Hard, strong, coarse-grained, durable in contact with ground; reddish-brown in color with thin, pale sapwood. Used for fence posts, fuel, crossties, hubs for wheels; propagated as hedge plant, for erosion control within its range.

Range—Found southern Ontario west to eastern Nebraska, Kansas south to Florida, Texas. Limited in Minnesota; occurs as scattered individuals and small stands particularly near Mississippi bottom lands of southeastern Minnesota. Prefers rich but not moist soil. Will do well on hillsides.

## SUGAR MAPLE (Hard Maple)
(*Acer saccharum* Marsh.)

HABIT—Fairly large tree usually 40 to 70 feet high with trunk diameter of 16 inches to 3 feet. Under optimum conditions the tree may be found even larger. Under forest conditions has a straight, clean trunk free of branches for 35 to 50 feet, with a shallow, rounded crown, only few large limbs. In the open has a symmetrical, oval, dense crown, affording heavy shade, but with a trunk that divides 8 to 10 feet above the ground.

LEAVES—Opposite, large, 3 to 5 inches across with 3 to 5 pointed, smooth, margined lobes which are rounded. At maturity leaves thin, shiny, dark green above, paler below, turning to dark red, scarlet, orange, or yellow in autumn.

FRUIT — A two-winged "samara" or "key-like" seed, reddish-brown when ripe in early fall; seed equipped with thin scale-like wing to aid in distribution by wind; seed borne in clusters.

HARD MAPLE
SUGAR MAPLE
Leaf, one-third; fruit and twig, one-half natural size

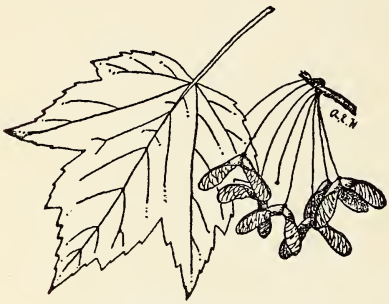
BARK—Young bark reddish-brown to light gray, smooth; mature bark thick, light, grayish-brown, broken up into deep furrows, long ridges, scaly at the surface.

WOOD AND USES—Hard, heavy, strong, close-grained; light brown in color with paler heartwood. One of our most valuable hardwood trees; of great commercial importance; used for interior finish, furniture; prized for cabinet work and a great variety of novelties; high fuel value; two valuable products from this tree are maple syrup and maple sugar made by tapping the trees and evaporating the sap in the spring. Widely used in ornamental planting.

RANGE—Northern and central states south to Georgia. Found natural in north central Minnesota; Mississippi Valley extending a little westward along stream courses. Prefers rich, well-drained soils, cool situations.

## RED MAPLE (Swamp Maple)
## (*Acer rubrum* L.)

HABIT—Generally a medium-sized tree growing in lowland areas; 35 to 50 feet high, trunk diameter 10 inches to 2 feet. Quick grower but comparatively short-lived. In the open, trunk upright, with long, stout branches, forming compact, narrow, oval head. Under forest conditions, trunk longer and clear of branches, with narrow crown.



RED MAPLE
Leaf and fruit, one-third natural size

LEAVES — Opposite on stem, 2 to 5 inches long, 3 to 5 pointed, saw-toothed lobes, separated by sharp angular openings. At maturity bright green in color, whitish below, partly hairy. In autumn leaves turn brilliant shades of red, orange and yellow. First of maples to turn in fall. Winter buds are small, red, and round or blunt-pointed.

FRUIT—A "samara," "key-like" in shape, hanging in clusters; red, reddish-brown, or yellow in color. Wings much smaller than those of hard maple. Winter-seed matures in late spring (May or June).

BARK—On young growth smooth and light gray, tinged with red. Mature bark thin, dark gray, rough, divided by shallow fissures into long ridges separating into long plates at surface, shaggy appearance. Bark sometimes used in dyeing.

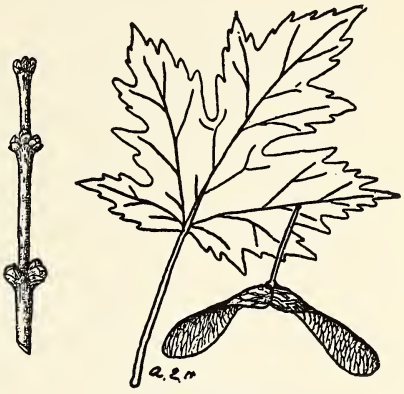
WOOD AND USES—Heavy, close-grained, rather weak; light brown in color with thick, paler sapwood. Used for cheap furniture, woodenware, and fuel. Because of its foliage, which is beautiful in summer and fall, used in ornamental planting; not sufficiently hardy for city streets.

RANGE—Nova Scotia west through southern Canada, some of northern states, lake states south to Florida and Texas. In Minnesota eastern half of state as far south as Houston County, as far west as line running from Mahnomen to Redwood Falls.

## SOFT MAPLE (Silver Maple)
## (*Acer saccharinum* L.)

HABIT—A fairly large tree, 55 to 85 or more feet in height and trunk over 3 feet in diameter on good sites. Usually a short trunk which divides into number of large ascending branches that are more or less brittle, forming a broad, rounded crown. Quick growing; when young has graceful appearance.

LEAVES— Opposite, with 3 to 5 lobes ending in long points with toothed edges, separated by deep angular openings; downy when young. When mature, leaves are thin, pale green, shiny above; silvery white below with reddish petiole. Reddish-brown, rounded, blunt-pointed winter buds.



SOFT MAPLE
SILVER MAPLE
Twig, one-half; leaf and fruit, one-third natural size

FRUIT—Winged seeds or "keys" with wings 1 to 2 inches long on slender, flexible, threadlike stems; seed reddish-brown when ripe in April or May.

BARK—On young growth smooth, thin, reddish to a yellow-gray in color; when young twigs are cut, they give off a rank odor. Mature bark thin, reddish-brown to gray, separating at the surface into long, loose plates.

WOOD AND USES—Medium hard, heavy, brittle, close-grained, even texture, easily worked; light brown in color with thick, paler sapwood. Used for cheap furniture and flooring, fuel; often used for lawn planting on good soils, but its tendency to form crotches and brittle limbs makes it less desirable because of frequent wind breakage. Will grow on a variety of soils; used in shelter belt plantings.

RANGE—Prefers moist situations along stream courses but will grow on dry soils. New Brunswick through southern Ontario to eastern South Dakota, Nebraska south through United States to western Florida. Common in southern Minnesota and scattered in the north.

## BOX ELDER
(*Acer negundo* L.)

HABIT—Tree of medium size, reaching height of 50 to 65 feet and diameter of 18 inches to 2 feet or more under very favorable circumstances. Fast grower, hardy. Trunk short and begins to divide quite close to ground into stout, spreading, brittle branches, forming a broad, round bushy crown.

BOX ELDER
Twig, two-thirds; leaf, one-third natural size

LEAVES—Opposite, compound, usually with 3 to 5 leaflets, rarely 7 or 9; thin, light green, shiny above; paler and smooth below.

FRUIT—A "samara" or "key," similar to other maples but smaller; reddish-brown when ripe in autumn, often hanging on the tree well into or through winter.

BARK—Young bark green or purplish-green in color, thin, smooth, shiny, and toward end growth covered by a hairy bloom. Mature bark thin, grayish to light brown, shallow grooves with narrow ridges.

WOOD AND USES—Of little commercial value or use. Wood soft, light, weak, close-grained; creamy white in color; decays rapidly in contact with ground. May be used in manufacture of cheap furniture, woodenware; fairly good fuel. On account of its hardiness widely used in dry prairie planting. Too often used along city streets and in yards. Inferior to other maples for this purpose.

RANGE—Widely distributed over North America. In Minnesota found common through state, less often in the northeastern portion. Prefers moist situations but will thrive on very dry, difficult sites.

## WHITE ASH
(*Fraxinus americana* L.)

HABIT—A fairly large, valuable tree, reaching a height of 60 to 90 feet and a trunk diameter of 2 to 3 or more feet on good sites. In natural forest, trunk straight, massive, with a narrow, pyramidal crown. Found in the open,

WHITE ASH
Twig, one-half; leaf and fruit, one-third natural size

trunk has branches close to ground, crown broad, pyramidal, round-topped. A graceful tree.

LEAVES—Opposite, compound, consisting of 5 to 9, usually 7, stalked leaflets, arranged in pairs along stalk, except terminal leaflet. Leaves lance-shaped, sharp-pointed. At maturity leaves thick, dark green, and smooth above; pale green or whitish, somewhat hairy below.

FRUIT—Paddle-shaped, oblong, winged seed, light brown in color, borne in drooping clusters that usually persist through winter. Ripe in autumn.

BARK—On young growth, dark green, nearly smooth. Mature bark dark gray, thick, divided by deep, narrow, diamond-shaped fissures.

WOOD AND USES—Heavy, hard, strong, close-grained, tough; brownish in color with lighter sapwood. Very valuable timber tree. Wide variety of uses such as tool

handles, golf clubs, tennis rackets, baseball bats, oars, agricultural implements, woodenware, furniture, interior finish, posts, fuel, crossties, etc. Used as fine ornamental tree. Recommended for woodlot planting.

Range—Nova Scotia west through southern Canada to lake states, south to Florida and Texas. Not so common in Minnesota except in southeastern part of state. Most often confused with Green Ash. Makes best growth in rich, well-drained sites, but does well on fairly dry uplands.

## GREEN ASH

(*Fraxinus lanceolata* Bork. Sarg.)

Habit—Medium-sized tree, 40 to 60 feet high with a trunk diameter of 1 to 2 or more feet on good sites. In the open, crown is broad, round-topped with spreading branches extending fairly close to the ground.

Green Ash
Twig, two-thirds; leaf and fruit, one-third natural size

Leaves—Compound, 10 to 12 inches long, 7 to 9 stalked leaflets borne opposite on stout, shiny stem. Leaflets lance-shaped, sharply-toothed along margins; bright green on both sides at maturity, differing in this respect from leaves of White Ash.

Fruit—Similar to that of White Ash; light brown

when mature, flat and winged, wing portion extending well past the middle of seed-bearing part, wing often slightly notched at outer end. Ripe in autumn. Seed often persists on tree through winter. Readily grown from seed.

Bark—On young growth lighter-colored than White Ash and shows more white markings or spots. Mature bark one-half inch or more in thickness, dark brown or gray, often tinged with red; strongly furrowed or ridged.

Wood and Uses—Heavy, hard, strong, brittle, coarse-grained; light brown in color with paler sapwood. Used for same purpose as White Ash. One of our hardiest trees extensively used in farm windbreak, shelter belt, and ornamental plantings. Most common ash in Minnesota. Fairly fast grower.

Range—New York west to lake states and valley of Saskatchewan; east range of Rockies south into gulf states and Arizona. In Minnesota common throughout state except in farther western prairie region; most abundant along stream and watercourses. Grows best in rich, damp situations but will thrive on very dry exposed sites.

## BLACK ASH (Swamp Ash)
## (*Fraxinus nigra* Marsh.)

Habit—Generally a medium-sized tree 40 to 65 feet high with trunk diameter of from 1 foot to 20 inches. Trunk straight, clean, slender, with a narrow, high crown. In open, trunk short with a roundish-topped crown, extending branches nearly to ground.

Leaves—Similar to those of other ashes; 7 to 11 oblong or lance-shaped leaflets borne opposite without stalks on pale, stout, leaf-stem. Leaflets smooth on both sides, dark green, shiny above, paler below with tufts of hair noticeable along midrib. Crushed foliage has an Elder odor.

Fruit—Same type of seed as other ashes; seed-bearing portion terminated by a definitely-notched wing; seed differing from other ashes will not come up first season after planting. Seed matures on tree in early autumn.

Bark—Young bark grayish to light orange, marked with conspicuous, light-colored streaks. Old bark grayish to nearly black, furrowed, divided by shallow fissures into narrow, scaly, corky ridges easily rubbed off.

Wood and Uses—Heavy, coarse-grained, brittle, weak, tough, fairly durable; dark brown with paler sap-

wood. On account of toughness and ease of separating annual ring growth, used for baskets, hoops, and chair bottoms; fuel, occasionally for posts.

Black Ash
Leaf and fruit, one-third; twig, natural size

Range—Cold wet swamps and lowland areas, watercourses, etc. Newfoundland to Manitoba, north border states, lake states, south to Virginia and Arkansas. In Minnesota fairly common in lowland areas of east half of the state.

## BASSWOOD (Linden)
(*Tilia glabra* Vent.)

Habit—A large, handsome tree, on good sites reaching a height of 60 to 80 feet and trunk diameter of 1 to 3 feet or more. In forest, trunk straight, bearing slender, horizontal branches, forming a high, rounded head. In the open, short, straight trunk having branches fairly close to the ground.

Leaves—Large, heart-shaped, alternate; coarse, incurved teeth along outer margins. At maturity thick, dark green and shiny above, paler below; borne on slender leaf stems.

Fruit—A berry-like, dry, grayish, rounded, hairy, woody seed about size of a dry pea; borne in clusters; seed attached to a leafy bract which later helps as wing

Basswood
Twig, one-half; leaf and fruit, one-third natural size

in distribution. Ripe in autumn. Seed may persist on tree all winter. Fragrant, yellowish-white flowers appear in early July.

Bark—Young growth shiny, reddish to dark gray, smooth; mature bark smooth, light brown, thin, divided by shallow fissures into rounded ridges, scaly at the surface.

Wood and Uses—Light, soft, warps easily if not properly dried, not durable, fine texture, easily worked, even grained; light brown in color with scarcely distinguishable sapwood. Used for boxing material, paper pulp, excelsior, drawing boards, trunks, woodenware, barrel heads, cheap furniture, interior finish, veneer. Planted by beekeepers because of fragrant flowers. Has fine ornamental advantages. Inner bark tough and used for mat fiber, cordage, etc.

Range—New Brunswick west through southern Canada to Manitoba, southward to Georgia and eastern Texas. Fairly common in native hardwood forest of Minnesota except in extreme northeastern portion. Prefers rich, loamy, moist soils, usually found in combination with other hardwood species.

# VII

# CONCLUSION

THOUGHTFUL, progressive and interested citizens can do much in a helpful way to aid in tree culture, protection and encouragement. Not all the worthwhileness of Minnesota's trees and forest lies in the various uses and products that come from their industrial and economic uses.

It would be difficult indeed to imagine what our state would be like without beautiful trees and forests, our eleven thousand lakes, our streams, game, fish, and the recreational opportunities they provide. Trees were God's first temples and through the ages have contributed greatly to our spiritual needs and development. Beauty of trees and landscape appeal to us all.

Each tree or group of trees has something characteristic and definite to contribute, something that sets each tree or group of trees apart from others.

It is hoped that this book has introduced you to many of my personal friends, that will enrich your life in the future and contribute to a fuller life out-of-doors. Trees, when we get to know them more intimately, can teach us much of life and living. Man must still heed Nature's constant laws if he would continue to live and enjoy her endowments. All life on earth is bound up in her mandates and it is our task to learn them and to profit by them.

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